UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

4WD-SSMB

MEMORANDUM

SUBJECT: Sherwood Medical Industries Superfund Site
Five-Year Review

FROM: Mark J. Fite, Remedial Project Manager
South Site Management Branch

THRU: Curt Fehn, Chief
South Site Management Branch

TO: Richard D. Green, Director
Waste Management Division

Attached please find the Five-Year Review Report for the Sherwood Medical Industries Superfund Site in DeLand, Volusia County, Florida. Section 121(C) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, requires that if a remedial action is taken that results in any hazardous substances, pollutants, or contaminants remaining at the site, the Environmental Protection Agency (EPA) shall review the remedial action no less often than each five years after initiation of the remedial action to assure that human health and the environment are being protected by the rernedial action being implemented.

Soil, groundwater, and sediment contamintation are addressed at the Sherwood Medical Industries Site through three Operable Units. The selected remedy for the site includes extraction and treatment of contaminated groundwater from the surficial and Floridan aquifers, institutional controls to prevent exposure to soil and sediment contamination, and fish tissue, surface water, and sediment monitoring to address contamination in Lake Miller. The Remedial Action commenced in April 1992 and a Construction Completion Certification was documented in the No Action ROD for OU3 on September 18, 1997. Long-term groundwater extraction and treatment and semi-annual monitoring of groundwater, surface water, and sediment are on-going.

Based on present site conditions, review of historical semi-annual monitoring data, a site visit, and interviews conducted during the Five-Year Review, the remedy is expected to rneet the requirements of the Record of Decision (ROD) to ensure protectiveness. The attached Five-Year Review Report describes the progress of groundwater remediation at the site, documents deficiencies in operation & maintenance (O&M), and identifies remedial measures being implemented to address the deficiencies. The report concludes that the performance standards for the remedy remain protective. A revised O&M Plan has been developed, and a work plan has been submitted to EPA as a result of the Five-Year Review process to collect additional data needed for the next five year review. EPA recommends continuing operation of the groundwater

extraction and treatment system and semi-annual monitoring of groundwater, surface water, and sediment until Remedial Action Objectives are achieved as specified in the ROD.

Attachment

Approved by: _____ Date: 22 DEC 99

Richard D. Green, Director
Waste Management Division
US EPA Region 4

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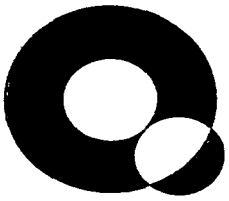

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FIVE YEAR RECORD OF DECISION REVIEW
SHERWOOD MEDICAL NPL SITE
DELAND, FLORIDA

CELEBRATING 30 YEARS

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Prepared for:
United States Environmental Protection Agency
Region IV
Atlanta, Georgia

Prepared by:
American Home Products Corporation
Parsippany, New Jersey
Project No. 3197659

DECEMBER 1999

FIVE YEAR RECORD OF DECISION REVIEW
SHERWOOD MEDICAL NPL SITE
DELAND, FLORIDA

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1.0 Introduction

American Home Products Corporation has conducted a five-year review of the Record of Decisions (RODs) at the Sherwood Medical Industries NPL site (Sherwood) in Deland, Florida. This review has been conducted on behalf of the United States Environmental Protection Agency (EPA). The primary purpose of the review is to determine whether the remedy remains protective of human health and the environment. Five-year review reports identify deficiencies, if any, and recommendations to address them. Five-year review reports document the evaluation of the implementation of the remedy and operation and maintenance, as well as the continued appropriateness of remedial action objectives, including cleanup levels at a site.

Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and Section 300.430 (f) (4) (ii) of the National Oil and Hazardous Substance Contingency Plan (NCP), require that periodic (no less often than every five years) reviews be conducted for sites where hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure following the completion of all remedial actions.

This is the first five-year review for the Sherwood site. Due to the complexity of the Sherwood site, site actions were addressed as three operable units. An interim action, outlined in a Record of Decision dated March 27, 1991, initially addressed contamination in the surficial aquifer and was known as Operable Unit 2 (OU2) in the site management strategy. The OU2 remedy was an interim action which included the construction of the current groundwater recovery and treatment system. This treatment system was incorporated into the final remedy (Operable Unit 1) and no further actions are required for OU2. To address concerns about the sediments of Lake Miller, Operable Unit 3 (OU3) was established and a ROD was signed on October 18, 1997.

The trigger for this 5-year review is the signing of the Record of Decision for Operable Unit 2 on March 27, 1991. For sites such as Sherwood with multiple operable units, EPA guidance requires that the 5-year review be conducted for the entire site in order to present the interaction of the implemented remedial actions and how they have impacted the site as a whole.

The OU-2 interim ROD presented the selected remedy for the site; groundwater recovery and treatment and the establishment of institutional controls as an interim measure protective of Lake Miller. The OU-1 ROD incorporated the selected interim remedy identified in the OU-1 ROD as the final remedy for groundwater at the site. The groundwater recovery and treatment system is currently addressing contamination (VOC's) within the surficial groundwater. Institutional controls, including requirements for continued operation of the treatment system on the plant water supply well, the testing of soils for chromium during invasive actions, establishment of deed controls and the posting of warning signs around Lake Miller were also presented in the ROD for OU-1. The waters and sediments of Lake Miller were classified as a separate operable unit (OU-3) and are being administered under a ROD specific to those media. This ROD did not incorporate a remedial action, but requires a one-time sampling and analysis of fish from Lake Miller and adjacent lakes and bi-annual sampling and analysis of the surface waters and sediments of Lake Miller.

The EPA has established a tiered approach to conducting five-year reviews, which allows reviews to be tailored to the status of activities onsite and to site-specific considerations. Four levels of review have been established 1,2,3 and 1a that detail the type of activities which should take place. Level 1 represents the fundamental review type, and is appropriate for most sites where construction is complete. Levels 2 and 3 represent enhanced levels of review needed to address site-specific considerations. A recalculation of risk is a typical feature of a level 2 review. A new risk assessment is a typical feature of a level 3 review. Level 1a reviews, which were developed for sites with an ongoing response, generally apply to sites where construction is not complete. A site visit, interviews, and ARARs review are not needed at the 1a review level.

As a general rule, for sites such as Sherwood with multiple operable units, the level of review is determined separately at each operable unit and the level of review for the whole site is determined by the highest level review for an operable unit. In evaluating the levels of review appropriate it was determined that no review was necessary for OU-2 as the remedy had been wholly incorporated into the ROD for OU-1. It was determined that a level 1 review was appropriate for the selected remedies at OU-1 and OU-3 and therefore a level 1 review would be completed for the Sherwood site as a whole.

O&M Plan Note

Throughout this report are references to the "O&M plan". Operation and Maintenance of the remedy at the site was evaluated as a part of this review. In response to this evaluation, a new sitewide O&M Plan was developed incorporating the requirements of the RODs for OU-1 and OU-3 into a single plan. This unified plan is scheduled to be submitted to the EPA and FDEP in December, 1999, although most components of the plan were implemented in May, 1998. Throughout this review document this pending plan will be referenced as the "O&M plan".

2.0 Site Background

Information presented in this section previously appeared in the Final Remedial Investigation Report (7/92) prepared by the Roy F. Weston Company.

2.1 Physical Characteristics

2.1.1 Site Location

The Sherwood site occupies approximately 43 acres and is located in northeast Florida, approximately 3 miles northeast of downtown DeLand, in Volusia County. **Figure 1** shows the geographic location of the Sherwood site and the surrounding areas. The northern boundary of the site is U.S. Highway 92 (State Route 600), beyond which are several small subdivisions, woodlands, and pasture land. The eastern boundary of the site is Kepler Road (State Route 430A). Across from Sherwood along Kepler Road are several private residences served by individual deep wells and septic tank systems. At the southern end of the site the Florida Department of Transportation occupies a 17-acre maintenance yard and construction office. The western boundary of the site transects Lake Miller and adjacent wooded areas and wetlands.

2.1.2 Topography and Surface Drainage

The Sherwood site is located on the eastern flank of the Deland Ridge, a north/south trending topographic feature of the Eastern Valley physiographic region of Florida. The Deland Ridge is characterized by numerous sinkhole-related lakes and karst features. The ridge represents a topographic high in this area of Volusia County, with surface elevations ranging between 40 and 85 ft above mean sea level (MSL). The site itself slopes at an approximate 2% grade toward the southwest, from an elevation of approximately 75 ft above MSL along Kepler Road to the control elevation of Lake Miller at approximately 55 ft above MSL.

The most significant surface water feature in the immediate vicinity of Sherwood is Lake Miller, located on the western site boundary. The lake is approximately 6 ft deep. The lake receives water from surficial aquifer discharge from the east, from the bordering wetlands to the southwest, and North Lake Talmadge from the south via a narrow channel. Drainage from Lake Miller is northward throughout the channelized Little Haw Creek into distant wetlands. Flow into Little Haw

Creek from Lake Miller is controlled by a weir located just upstream (to the south) of a culvert under U.S. Highway 92.

2.1.3 Climate

The climate of Volusia County is subtropical, with a mean annual temperature of 71EF. The average rainfall in Deland is approximately 53 inches annually, with precipitation rates being greatest during early fall.

2.1.4 Soils

The soil units in the region of the site are characteristic of flatwood areas and belong to the Myakka-Smyrna-Immokalee series. These soils are nearly level and poorly to moderately drained with a dark, organic-stained subsoil underlain by sandy material interspersed with swamps and poorly defined drainage ways. The predominant soil units in the vicinity of the Sherwood site are the Daytona sand and the Samsula muck. The Daytona sand is generally found in the upgradient or northeast portions of the site, and is characteristically moderately well-drained, with the water table commonly at a depth of at least 40 to 50 inches from the surface during the wettest period of the year. The Samsula muck is found in the low-lying or southwest portions of the site in and around Lake Miller. The Samsula muck soils are typically poorly drained, nearly level, and high in organic content. The water table is located at orjust below the surface in the swampy marsh areas characteristic of Samsula muck.

2.1.5 Regional and Site-Specific Geology

The lithologic units in the region of the Sherwood site can be divided into three primary categories in terms of their stratigraphic characteristics and geologic ages. They are listed below in the sequence in which they are encountered:

1 . The unconsolidated surficial sandy deposits of Holocene to Pleistocene age.
2. The unconsolidated poorly sorted deposits of Pliocene to Miocene age.
3. The carbonate bedrock deposits of the Eocene age Avon Park Formation.

The surficial deposits in the area are composed of fine to medium-grained sands and silty sands of Holocene to Pleistocene age. Their thickness in the vicinity of the site ranges from 30 to 55 ft. They commonly contain some organic material in the upper 20 ft and may, in low-lying wetland areas, contain thick sequences of organic peat.

Directly underlying the surficial deposits in the area are sandy clays or clays that overlie poorly sorted deposits of shells, sands, silts, and clays. These deposits are of Pliocene to Miocene age. The total thickness of this unit in the vicinity of the site ranges from 35 to 55 ft.

The underlying carbonate bedrock is part of the Avon Park Formation of middle Eocene age. The Avon Park Formation in the vicinity of the site dips gently to the east at approximately 3 ft per mile and ranges in thickness from 800 to 1,000 ft.

The strata that comprise the Avon Park formation were originally deposited as carbonate shelf limestones, but have undergone extensive dolomitization. Beneath the site, the Avon Park Formation consists of interbedded white, tan, brown, and gray limestones and dolomites. The rocks range in texture from chalky to vuggy (solution-pitted) to densely crystalline and are highly fossiliferous in places.

2.1.6 Regional and Site-Specific Hydrogeology

The hydrogeologic units at the Sherwood site include the surficial unconfined aquifer, the confining unit, and the confined Floridan, upper and lower, aquifer system. The surficial aquifer is comprised of permeable silty sands that extend from ground surface to the top of the confining unit. Use of groundwater from the surficial aquifer is restricted to agricultural purposes and is not known to be used as a source of drinking water. The saturated thickness of the surficial aquifer ranges between 30 and 49 ft onsite, depending on the elevations of both the water table and the confining clay surface. Contour mapping of the clay surface beneath the site has shown elevation changes of more than 18 ft. Water level elevations across the site indicate elevation changes of approximately 12 ft moving from northeast to southwest. The hydraulic conductivity of these surficial deposits is relatively moderate, with values ranging between 0.001 and 3.5 ft/day.

The confining unit underlying the surficial aquifer is comprised of a 4 to 8-ft-thick clay to sandy clay that overlies a 35 to 40-ft-thick poorly sorted deposit of shells, sand, silt, and clay. Collectively, these sediments serve to restrict the vertical movement of water from the surficial aquifer to the confined Floridan aquifer system below. Hydraulic conductivity in the confining unit is relatively low, with values ranging between 3.3×10^{-5} and 0. 02 ft/day.

The Floridan aquifer beneath the site is a highly productive confined system comprised of interbedded carbonates of limestone and dolomite. Groundwater from the Floridan aquifer is used for domestic, industrial, and agricultural purposes. Most domestic water wells are completed within the Upper Floridan aquifer. Regionally, the Floridan aquifer system consists of an Upper and a Lower Floridan aquifer separated by confining units of low-permeability rock. These zones of low permeability rock have been described as densely crystalline dolomites in the Volusia County area. These relatively impermeable layers appear to be parallel to bedding planes, continuous over large areas, and serve to retard the downward movement of water from the Upper to the Lower Floridan aquifer. In areas where the hydraulic gradient is downward and wells penetrate both the upper and lower parts of the aquifer, substantial downward movement of water from the upper to the lower parts of the aquifer through the well bores has been observed. Permeability in the Upper and Lower Floridan aquifer system is high, with an average hydraulic conductivity of 15 ft/day. Porosity is both primary (intergranular) and secondary, with abundant fractures, vugs, and solution openings characterizing the carbonates of the Avon Park Formation. The saltwater/freshwater interface beneath the Sherwood site is at approximately -1,000 ft MSL.

2.2 Land Use and Demographics

2.2.1 Location and Site Description

The Sherwood site is situated in a low topographic area 40 to 60 ft above MSL. The region can best be described as floodplain with flatland soil. The foliage is a combination of deciduous and coniferous trees with grazing lands and wetlands. Due to the large number of freshwater lakes (e.g., Lake Miller, Cypress Lake, North and South Lake Talmadge) and low topography, much of the area is best described as wooded marsh.

2.2.2 Residential and Commercial Land Use Within a 1-Mile Radius

Area surrounding the Sherwood site is primarily residential, with some commercial properties. The residential areas have been divided into tracts with 6-acre lots. According to real estate maps, 95% of the individual parcels of land (419 out of 440) within a 0.5-mile target area are north or east of the site. Most of the residential areas (Deland Highlands, Cypress Lake, and Daytona Park Estates) are sparsely populated and their growth is restricted by stringent zoning codes.

2.2.2.1 Southern Area

Woodland and wooded marsh occupy approximately 200 acres of land to the south of the site. Most of this land is owned in large tracts. A local electrical company owns a large amount of land in this area. Little development is present in this area, except for the Florida Department of Transportation maintenance yard and construction office which adjoins the property to the south.

2.2.2.2 Eastern Area

The area to the east of the site is almost entirely residential. However, the population is sparse. Next to the site on Kepler road is an 80-acre residential area with 15 homes known as Cypress Lake Estates. Approximately 1,000 ft to the east of the Sherwood site lies a residential area occupying 1 to 2 square miles known as Daytona Park Estates.

2.2.2.3 Northern Area

North of U.S. Route 92 are approximately 280 acres of woodland. On the northern side of Daytona Road lies a 150-acre, but moderately populated development known as Deland Highlands. This area has shown the greatest recent growth, and the size of the housing lots are the smallest in the area. Beyond Deland Highlands is a rural area.

2.2.2.4 Western Area

Southwest of the site the area is mostly wooded swamp. The northwestern area is within the Deland city limits. Northwest of the site are large tracts of land owned by the Deland Municipal H. Taylor Airport, the Florida Military School, and the Municipal Waterworks. At present, the land is sparsely populated. The closest residential property lies on the western side of Lake Miller.

2.2.3 Local Agricultural Land Use

Farming in the area is relatively sparse due to the unsuitability of prevalent wetland terrain. However, farms are present in the area, and the agricultural production ranking of Volusia County is midrange when compared to other counties in Florida. Citrus orchards are present locally; however, the number of orchards in the county has decreased in recent years due to low winter temperatures. An orchard is located 2,500 ft to the northwest of the site at the intersection of Pine and Marsh Roads. There are no dairy farms in the area, although the open flatlands are considered suitable for grazing.

2.2.4 Local Recreational Land Use

The land near the Sherwood site is known to support recreational activities, including fishing, hunting, boating, and swimming. Lakes generally used for fishing in the area include Cypress, Daytona, and Talmadge. Swimming and gasoline-powered boating are common in North and South Lake Talmadge. Because of the relatively large tracts of undeveloped land, hunting occurs in the area. Dominant game species that are reported to be present in this general area of Florida include white tail deer, gray squirrel, turkey, eastern cottontail rabbit, morning dove, bobwhite quail, and black bear. Hunting activities are generally confined to the southern portion of the site, in the woodland and wooded marsh area.

The closest surface water body which supports aquatic life in the vicinity of the site is Lake Miller. Most of the lake is located on a large tract of privately owned land, and the remainder of the lake is on the Sherwood property. This lake previously supported limited recreational activities, mostly fishing. Access to the lake has been prohibited as a condition of the ROD. Fish species found in Lake Miller that may be of interest to local recreational fisherman include bluegill, large-mouth bass, sunfish, and black crappie.

2.2.5 Public and Private Water Supply Wells

During the Remedial Investigation, a comprehensive groundwater receptor survey was completed to determine all groundwater usage from public and private supply wells within a 0.5- mile radius of the site. The water utility for the City of Deland does not provide public service to any property within a 0.5- mile radius of the Sherwood facility with the exception of the connection to the Sherwood facility. The City of Deland supply wells are located to the west and southwest of the

Sherwood property and tap the Floridan aquifer. The closest public supply well is city production well 6A, located at the intersection of East Minnesota and Kansas Avenue, approximately 2.5 miles to the west/southwest of the site. Another city well is located at the intersection of North Street and North Florida Avenue, approximately 2.5 miles to the west of the site.

During the RI, nine private wells were identified on property adjacent to the site. Each of these wells is completed in the Upper Floridan aquifer. The Florist well is the nearest well and it is located approximately 150 ft to the east of the southeast corner of the site. Seven additional wells were located along Kepler Road to the east of the site, and one well (Mills well) was located approximately 800 ft to the west of the site, on the western shore of Lake Miller.

Seven of the private wells in the vicinity have been monitored throughout the five-year period. Four of these wells are currently out of service due to damage to the wells or changes in land usage.

2.2.6. Demographics

As of 1990, population and housing within a 1 -mile radius of the site remained relatively sparse. High housing costs, drought conditions, and sparsely populated residential lots have contributed to the slow development. However, there is the potential for future growth near the site.

The population of Deland grew at a rate of 18.4% during the period of 1980 through 1986. The population of Volusia County has nearly doubled in the past 20 years. This population increase can be linked to three factors: the propagation of the tourist trade in Daytona Beach; the growth of industry in the county; and the redistribution of land into residential developments. There are three residential developments within a 1 -mile radius of the site. Census tract data for 1970 and 1980 show the growth in the residential tract.

Demographics outside of the 1 -mile radius from the Sherwood facility are represented by data for Deland, which is the nearest city, and the overall county census figures. Prior population data are given to indicate growth in the area. Projected census information was only available for the county. However, much of the past growth has come from the Daytona Beach location 20 miles to the east of the Sherwood site.

2.2.7 Ecological Setting

The area in which the Sherwood site is located is part of the Outer Coastal Plain Forest ecoregion. This ecoregion is dominated primarily by beach, sweetgum, magnolia, pine, and oak forests. The site itself is dominated by an active industrial infrastructure (i.e., manufacturing facilities, parking lots, roads, etc.) that encompasses approximately 55% of its total area. The predominant natural feature at the site is Lake Miller, a 12-acre swamp lake that receives recharge from:

- North Lake Talmadge via a narrow canal
- The surficial aquifer
- Surface runoff from the site

The vegetative communities onsite include several weed-dominated herbaceous plots located in percolation and retention basins; a mesic/hydric hammock forest community situated on the south-central and southwestern edges of the site; an emergent/shrub-shrub wetland area that borders Lake Miller; and interspersed mowed lawns. The neighboring natural communities are vegetatively similar, with numerous oligo-mesotrophic lakes and vegetated wetlands scattered throughout.

Potential species of special concern were identified through the Florida Natural Areas Inventory Database (FNAI) during the initial investigations for an area within a 1-mile radius around the site. Two threatened species identified at the site are the Florida Scrub Jay and the Florida Pine Snake. A candidate species listed for the site is the Florida Long-Tailed Weasel. The Bald Eagle, which is a Federally Endangered Species, but is considered threatened by the State of Florida, was also identified in the FNAI search.

2.3 Site Operations and Chemicals of Concern

The summary of site operations given in the subsequent subsections is based on previous reports prepared for the Sherwood site and from the final Record of Decision. A chronology of the NPL listing activities and interim remedial actions completed at the site is presented as **Table 1**.

Sherwood Medical Industries began operations in Volusia County, Florida, in 1959 as a manufacturer of stainless steel medical supplies; the company continues to operate at this site today. The present site boundaries were established in 1962. The plant was originally owned by the Brunswick Corporation, which subsequently sold the facility to American Home Products Corporation (AHPC) in 1982. AHPC sold the corporation to TYCO Industries effective March, 1998. On June 23, 1998, prior to the sale, AHPC notified the EPA as per the consent decree, that AHPC would contractually retain responsibility for the NPL issues at the site.

The Sherwood site contains manufacturing buildings, a biological laboratory, parking areas, and additional structures that include a swimming pool (designated as an emergency firefighting water supply), a wastewater treatment plant, and chemical, hazardous waste, and product storage facilities.

Initial industrial operations by Sherwood commenced in Building B and included grinding, cleaning, and fabrication of stainless steel and aluminum parts used in the manufacture of hypodermic syringes. Aqueous wastes from these processes were discharged to a septic tank and a graded sump located south of Building B, and were drained in a west / southwesterly direction into a septic tank drain field. Building B originally had several floor drains, including storm drains that were connected to a 14-inch concrete storm drain pipe leading to the eastern bank of Lake Miller.

In 1961, Building F was acquired by Sherwood from a former boat kit manufacturer. Grinding operations were relocated from Building B to Building F. While in use in Building F, each grinder was equipped with a 40-gallon coolant recirculating tank. These tanks were cleaned twice weekly using detergents and tetrachloroethene (also known as perchloroethylene (PCE)). Discharges from cleaning these grinders were directed to two septic tanks located south of Building F, and ultimately to a drain field near Building B located southwest of the building. In 1961, a separate, small manufacturing shed was constructed to the south and west of Building F and this shed was operated until 1963. Small quantities of waste nitric acid were generated in the decoring shed. These wastes were discharged to another septic tank located south of Building B and were eventually drained into the septic tank drain field near Building B.

Building A was constructed in 1963 and all manufacturing operations were relocated to that building. These activities included processing of aluminum alloy hubs, grinding of hypodermic syringes, plastic molding of the syringes, and in-house laboratory testing. Building A has undergone numerous expansions since its 1963 occupancy, with subsequent revision and expansion of its original stormwater, sanitary, and industrial wastewater treatment systems. During the expansion of Building A, the stormwater collection system was expanded and at times received discharges of floor washings from the process areas. These washings are believed to have contained PCE. The upgraded stormwater system drained into the retention basin located near the existing Industrial Wastewater Treatment Plant (IWTP). PCE is no longer used as a degreaser in Building A. Currently, the retention basin does not receive any wastewater discharge from Building A, but is still used for stormwater runoff retention.

Figure 2 shows a layout of the plant and presents historic disposal locations as identified in existing reports.

2.4 Initial Responses and Current Waste Disposal Operations

2.4.1 Surface Impoundments

An estimated 2 tons of liquid and sludge containing chromium were discharged from 1971 to 1980 into the percolation ponds constructed east of Building A between the main plant building and Kepler Road. The sodium dichromate was generated from the treatment of cooling tower blowdown water. Nitrate-bearing wastes from production processes were also discharged to these ponds. Each of the ponds had an approximate volume of 125,000 ft^3; the ponds were in use from 1963 to 1982. After these ponds were constructed, the slow accumulation of suspended solids over the years reduced percolation in the ponds so that periodic sludge removal was required. Approximately 600 to 900 lb/yr of sludge that was removed from the percolation ponds contained chromium and was temporarily stored in the form of waste piles located south of the percolation ponds prior to their ultimate removal from the site between 1980 and 1982.

In 1985, Sherwood constructed an Industrial Waste Treatment Plant (IWTP). Its primary function is to effectively treat all chromium-bearing wastewater generated at the site prior to its discharge or disposal. Process wastewaters generated at the site are classified and segregated into two types. They are the nitrate and non-nitrate-bearing wastewaters. In the Sherwood IWTP, the nitrate-bearing wastewaters are treated in the "A" side of the IWTP, while the non-nitrate wastewaters are treated in the "B" side. Sanitary wastewater is treated onsite in a separate sewage treatment plant. The effluent from this sanitary wastewater treatment plant is mixed with the effluent from the IWTP and is discharged to the City of Deland sewage system.

Adjacent to the Biological Laboratory (Building C) is a retention basin that receives stormwater drainage from the area around Building C and part of Building A. The holding pond located between the wetlands and the aforementioned retention basin originally received treated sanitary wastewater from the facility's sewage treatment plant. The effluent from this holding pond was pumped to the barrier pond for disposal. This holding pond is no longer in use with the exception of stormwater runoff retention. East of the Biological Laboratory is a lined holding pond that was used for the collection of the IWTP overflow/bypass.

No surface impoundments on the site currently receive any wastewater discharges since the construction of the wastewater plant and the sewer connection were completed. All wastewater is treated at the on-site treatment plant and is then discharged to the City of Deland sewage system.

2.4.2 Water Supply Sources

Initially, groundwater was withdrawn from two onsite wells completed in the Floridan aquifer to satisfy all of the water needs at the facility. Approximately 175,000 gallons per day (gpd) of groundwater were withdrawn from the Floridan aquifer, of which 25,000 gpd were used to satisfy the sanitary needs of the site.

When volatile organic chemicals (VOCs) were discovered in the IWTP, Sherwood conducted an investigation and found the onsite water supply well for the plant was the source. This investigation determined that the casings in three older water supply wells on the site had corroded allowing water from the surficial aquifer to drain into the Floridan aquifer. This water was found to contain VOCs. The casings in these wells were sealed and the wells were redrilled as Floridan aquifer monitoring wells. To ensure that these VOCs were removed from the process and potable water at the plant, an air stripping tower was designed to treat up to 350 gallons per minute (gpm) of water from the groundwater supply well. This air stripper was installed in 1986.

Currently the plant receives all potable water for the plant from the city of Deland. Industrial water is still provided by the on-site well. The ROD specified that this well was to continue operating and that the water would continue to be run through the air stripper. This action was implemented as the treatment remedy for VOC's detected in the Floridan Aquifer. At the time of this review, the site water supply well is operated at a rate of 300 gpm. Verification of the operation of the well and air stripper is a part of the weekly O&M activities at the site (See **Section 5.5.1**).

3.0 Development and Implementation of the Remedy and Operation and Maintenance

The Sherwood site has been the focus of environmental investigations from approximately October, 1980 when samples were collected from on-site ponds during the development of an initial groundwater monitoring program. At the request of the EPA a full remedial investigation under CERCLA was conducted at the site beginning in 1990. A chronology of events from the initiation of RI/FS activities through completion of the selected remedy is presented in **Table 2.** Media investigated included soil, groundwater, surface water, sediments and biological samples.

During this investigation, it was recognized that the waters of the surficial aquifer may have been impacting water quality within Lake Miller and the decision was made to divide the site investigations into two areas of concern; one being the soils and groundwater and one being Lake Miller surface waters and sediments. As the investigations progressed the soil and groundwater area at the site was designated as Operable Unit 1. In order to eliminate the impact of the surficial aquifer discharge to Lake Miller, plan was designed for the interception of groundwater through a series of recovery wells located between the source areas and the lake, and additional recovery wells were installed to prevent migration from a storage basin on the southeastern portion of the property. As this was originally designed an interim measure, it was given the designation Operable Unit 2, and an interim ROD was prepared. The investigation of Lake Miller was then given the designation of Operable Unit 3.

When the investigations of the soil and groundwater were completed the Feasibility Study determined that the interim remedial system was sufficient and this system, along with institutional controls, were presented in the ROD for OU-1. Investigations completed in Lake Miller determined that impacts to the surface waters and sediments had occurred but that no additional remedial measures were required. The ROD for OU-3 required that additional fish samples be collected and analyzed and that bi-annual monitoring of the surface waters and sediments be completed. This ROD also reiterated the institutional controls implemented with the signing of the ROD for OU-1.

The actions completed for OU-2 are considered complete in that they have been incorporated as the selected remedy for OU-1. This 5-year review therefore only covers OU-1 and OU-3. This section reviews the selection and implementation of the selected remedies.

3.1 Remedy Selection

The 5-year review pertains to the site as a whole and is meant to review the selected remedy for each operable unit. The only active remediation undergoing the 5-year review is that remedy associated with OU-1 of this site. No active remediation was implemented with the signing of the ROD for Lake Miller (OU-3). Monitoring requirements specified by the ROD for OU-3 have been Incorporated into the revised Operations and Maintenance Plan (O&M Plan) for the site. Operable Unit 1 encompasses only the groundwater and soils of the site.

3.1.1 Groundwater Operable Units (OU-1 and OU-2)

In conjunction with the completion of the Remedial Investigation of OU-1, a Feasibility Study (FS) was conducted to develop and evaluate remedial alternatives to address the groundwater and soils at the Sherwood site. The primary objective of the FS was to determine and evaluate alternatives for appropriate remedial action to prevent or mitigate the migration or the release or threatened release of hazardous substances from the Site.

The FS was conducted in several stages and used data gathered during the Remedial Investigation, as well as, data gathered during the Interim Remedial Measures study, for the identification of ARARs and management strategies and remedial alternatives to address groundwater issues at the Site. The groundwater beneath the Site was the primary medium of concern. The surficial aquifer is the primary source of VOCs at the Site. Significant amounts of VOCs were not present in the site soils; therefore, there were no contaminated solid wastes or residues which remained on-site that were contributing to site contamination. In addition, there was no significant migration of site-related substances, via surface water and sediments, beyond the eastern shore of Lake Miller, which is on the Sherwood property. Chemicals of concern detected in the Floridan Aquifer were limited to the plant property and were already being addressed through treatment of the plant water supply. Therefore, the focus of the FS was on the VOCs detected in the surficial aquifer and all possible points of migration. The primary VOCs detected in the surficial aquifer were PCE and TCE. Their products of degradation, such as 1, 2-

dichloroethylene and vinyl chloride, were also found in surficial groundwater. Site related metals such as trivalent chromium were detected at low levels in the surficial aquifer.

Remedial Action alternatives were initially identified and were subject to screening to identify the best possible alternatives for further consideration. The focus of the screening process was to eliminate technologies, based on information obtained from the studies conducted at the Site, that would not be implementable due to Site specific conditions or technical impractibility.

Following this screening process, four alternatives were retained for further consideration in the FS. A detailed evaluation of the remedial alternatives based on the following nine criteria was conducted. These criteria included:

- Overall protection of human health and environment;
- Compliance with applicable or relevant and appropriate requirements (ARARs);
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, and volume;
- Short-term effectiveness;
- Implement ability;
- Cost
- State/Support agency acceptance, and
- Community acceptance.

In addition a comparative analysis of the alternatives was included for the remaining alternatives, which compared the alternatives with each other.

Based upon consideration of the requirements of CERCLA, the NCP, the detailed analysis of alternatives, and public and state comments, EPA selected a remedy which consisted of a groundwater remedy and institutional controls. This remedy was first identified as an interim action and was constructed under an interim ROD for OU-2 which was signed on March 27,1991. Upon completion of the remedial investigation, the interim action was selected as the final remedy as documented in the OU-1 ROD signed in October, 1992.

The selected remedy originally consisted of the following components:

- Extraction of the affected groundwater from the surficial aquifer via the nine extraction well network;
- Treatment of the recovered surficial aquifer groundwater by an on-site air stripper for VOC removal;
- Discharge of treated water to Lake Miler;
- Groundwater monitoring;
- Access restrictions for the Site and Lake Miller;
- Other institutional controls including; a requirement for excavated soils to meet TCLP criteria or contain chromium at levels less than 520 mg/kg, and deed restrictions requiring that the Sherwood Medical site remain industrially zoned.
- Continued operation of the Floridan Aquifer groundwater recovery and treatment system associated with the Sherwood water supply well.

The surficial aquifer groundwater treatment system as installed originally included nine extraction wells and an air stripper. Following an initial round of effluent sampling, that indicated successful VOC removal, the system was started on July 31,1992. The number of recovery wells was reduced in 1998 when it was determined that the operation of three extraction wells in the southeastern portion of the property was no longer necessary. These wells were collecting little contaminated water and were serving to draw the main contaminant plume back away from the recovery wells situated along Lake Miller.

The basic components of the selected remedy for the surficial aquifer as originally designed are discussed in detail below. Some changes were made to the system in 1998 and those changes are described as well.

3.1.1.1 Groundwater Extraction

The objective of the groundwater extraction system was to efficiently and effectively recover VOCs exceeding site cleanup criteria present in the surficial aquifer groundwater by creating a groundwater capture zone. The six extraction wells located along the east side of Lake Miller were installed to capture groundwater moving toward the Lake. The three extraction wells in the southeast corner of the site were installed to reduce the potential for off-site migration of the substances of concern. This potential existed due to the mounding in the surficial aquifer caused by the discharge of treated wastewater from the IWTP. No impoundments at the site are currently being used to receive any wastewater discharge and these extraction wells have subsequently been turned off as it was determined that they were expanding the plume by drawing against the groundwater gradient established by the extraction wells located near Lake Miller. This decision was discussed in a meeting with EPA on September 30,1997 and approved in a letter dated October 1,1997.

Results of the design groundwater modeling indicated that the contaminants in the surficial aquifer would flow southwest towards the six wells located along the eastern side of Lake Miller, while a smaller portion would be directed to the three wells located in the southeast corner of the site. The maximum design yield from all of the wells combined was approximately 325 gpm. This maximum yield was not anticipated to be the operating capacity, but was used to size the air stripper and other components. The groundwater recovery system, as originally constructed, operated 9 recovery wells providing a total flow rate between 180 and 220 gpm of flow to the air stripper. With the shut down of three of the recovery wells in 1998 the flow to the air stripper dropped to between 130 and 160 gpm. The gradual drop in the flow rates are attributed to biological and mineral buildup on the recovery well components which serve to reduce the flow. These buildups are addressed during the routine O&M of the treatment system **(Section 5.5.2).**

The groundwater velocity across the site under pumping conditions was calculated to determine the amount of time required for groundwater to be intercepted by the extraction well field. Under ideal conditions, groundwater located upgradient across the Site from Lake Miller would require approximately 3 years to travel the 1,400 feet to reach the extraction well field and be intercepted.

3.1.1.2 Groundwater Treatment

Air stripping of the recovered surficial aquifer groundwater was the treatment technology to be utilized. The treated water was then to be discharged to Lake Miller. The volatile chemicals of concern in the surficial aquifer (primarily PCE and TCE) are easily stripped from the water to meet the applicable surface water quality standards for the discharged treated groundwater. Vinyl chloride and other VOCs determined to be present at lower levels are also easily stripped to meet surface water standards.

3.1.1.3 Treated Water Discharge

The treated water from the air stripper is discharged to Lake Miller. A single port diffuser was installed at the end of the discharge pipe at a distance of 60 feet from the shore. The treated effluent meets the discharge criteria of the Clean Water Act (40 C.F.R. §§ 122-125) including the substantive requirements of the NPDES program and all State and Local criteria.

3.1.1.4 Cleanup Levels

The purpose of this response action is to control risks posed by ingestion of surficial aquifer groundwater. The carcinogenic risk posed by a hypothetical future on-site resident ingesting surficial aquifer groundwater is $3.42X10^{-3}$. The hazard index associated with the same scenario is 1.32. Both of these values were above EPAs level of concern.

This remedy also addresses migration of chemicals of concern from the surficial aquifer to the Floridan Aquifer by requiring Sherwood to continue operating their Floridan Aquifer water supply well and associated treatment system.

Groundwater will have to meet clean-up criteria, in monitoring well samples, for two successive semi-annual sampling rounds in order for site remediation to be considered complete. The following table lists the remediation goals for specific compounds which correspond to the MCLs set by Florida groundwater regulations. The remediation goal for acetone represents Florida Groundwater Guidance Concentrations. These standards were reviewed during this review process and have not changed since the implementation of the remedy, and remain protective of human health and the environment.

Surficial Aquifer Cleanup Goals

Chemical	Cleanup Goal (ARAR)	Regulation
Acetone	0.700 mg/1	FGWGC
Tricholoroethene	0.003 mg/1	FAC 62-550
Tetrachloroethene	0.003 mg/1	FAC 62-550
1,2-dichlorethane	0.003 mg/1	FAC 62-550
Vinyl Chloride	0.001 mg/1	FAC 62-550
Chromium	0.10 mg/1	FAC 62-550 & SDWA

FGWGC *Florida Groundwater Guidance Concentration*

FAC *Florida Administrative Code*

SDWA *Safe Drinking Water Act*

3.1.1.5 Groundwater Monitoring

The groundwater monitoring program for the selected alternative includes:

- Lower Floridan wells MW-201 through MW-205 are monitored semi-annually for VOC,

- Lower Floridan wells SMWS and SMFW were monitored quarterly for the first year and semi-annually thereafter to determine the reduction of VOC concentrations due to the continued pumping from the on-site water supply well SMWS. Water pumped from the water supply well is currently routed through an air stripper operating at 300 gpm.

- Upper Floridan aquifer wells SMFA-1, SMFA-2, and SMFA-3 were monitored quarterly for the first year and semi-annually thereafter to determine the reduction of VOC due to continued pumping of on-site production wells SMWS and SMFW.

- Eight residential wells located east of the site on Kepler Road and one residential well located west of the site were to be sampled and analyzed for VOCs semi-annually. Several of these wells have been destroyed or taken out of service and only four remain available to be sampled.

- Water levels were recorded and samples taken from the surficial aquifer monitor wells (MW-101 through MW-114) were collected quarterly for the first year and semi-annually thereafter to determine the drawdown and VOC reduction in the surficial aquifer. In addition these samples are analyzed for metals.

3.1.1.6 Institutional Controls

Institutional controls include:

- Installation of 10 signboards around Lake Miller indicating "NO FISHING OR SWIMMING IN LAKE MILLER". Placement of these signs was reviewed by EPA personnel.

- Installation of signs on all sides of the groundwater treatment facility warning that it is a hazardous waste treatment facility.

- Notifying Mr. Mills, a property owner across Lake Miller from Sherwood, that Lake Miller should not be used for fishing or swimming purposes.

- Maintenance of the security fence to discourage trespassing on the Sherwood Site property and maintenance of the current Sherwood regulations restricting employee access to Lake Miller.

- Requirement that Sherwood notify FDEP and EPA of plans to excavate soils, demolish buildings, or remove pavement. Soils exposed as a result of these activities will be required to meet TCLP criteria or contain less than 520 mg/kg of chromium to remain on-site untreated.

- Requirement that the Sherwood Site remain an industrially zoned area or address elevated contaminant levels in all environmental media at the site such that the site does not pose a threat to human health and the environment as defined by EPA and FDEP.

3.1.2 Lake Miller Operable Unit (OU-3)

The investigations completed at Lake Miller determined that the implemented remedy associated with the groundwater OU eliminated the need for additional remedial action to address the contaminated sediment in Lake Miller. This ROD required that the O&M plan be revised to incorporate additional monitoring requirements to ensure that no unacceptable exposures to risks posed by conditions in the lake occur in the future. This monitoring includes a one-time fish tissue sampling event in Lake Miller and its adjoining lakes and the completion of semi-annual sediment and surface water sampling. The O&M plan for the site addresses these requirements. The ROD also restates the requirements for institutional controls as established in the ROD for OU-1.

3.2 Remedy Implementation

The final groundwater remedy as proposed was constructed as an interim remedial action under an Interim Record of Decision for OU-2 dated March 27,1991. This action was proposed so as to be protective of the waters of Lake Miller while the remedial investigation progressed. Upon completion of the remedial investigation it was determined that the interim measure was sufficient to be the final remedy for the groundwaters at the site and that additional tissue sampling and surface water/sediment monitoring be implemented . The implementation of these requirements is described in the following sections.

3.2.1 Groundwater Operable Units (OU-1 and OU-2)

3.2.1.1 Groundwater Extraction Wells

A total of nine extractions wells were installed at the site between January and April, 1991. Each well was equipped with a set speed submersible pump to approximate groundwater recovery at the design rate. Three of the extraction wells have subsequently been removed from service.

3.2.1.2 Groundwater Treatment

Recovered groundwater is treated at an on-site air stripper which was constructed between February and March, 1991. The tower was sized to handle the recovery system design maximum of 325 gpm but actually receives between currently 130 and 160 gpm. The tower is packed with 23 feet of media which results in approximately 400 cubic feet of surface area. This media was replaced in March, 1997.

3.2.1.3 Treated Water Discharge

Treated water from the air stripper is discharged to Lake Miller. This pipeline was installed in conjunction with the installation of the air stripper.

3.2.1.4 Cleanup Levels

Groundwater will have to meet clean-up criteria, in monitoring well samples, for two successive semi-annual sampling rounds in order for site remediation to be considered complete. The table presented in **Section 3.1.1.4** lists the remediation goals for specific compounds which correspond to the MCLs set by Florida groundwater regulations. The remediation goal for acetone represents Florida Groundwater Guidance Concentrations. These standards have not changed since the implementation of the remedy and remain protective of human health and the environment.

3.2.1.5 Groundwater Monitoring

Samples were collected from the air stripper discharge on a monthly basis beginning with the start up of the system in July, 1992 and a full groundwater sampling event was completed in December, 1992. Groundwater monitoring at the site continues to be completed on a semi-annual basis with samples being collected in June and December of each year. Sampling reports are prepared following each event and are due to EPA and the FDEP on January 15 and July 15 each year.

3.2.1.7 Institutional Controls

Institutional controls at the site are required by the RODs from OU-1 and OU-3. These controls (in **bold** type) and their implementation (in *italics*) include:

Installation of 10 signboards around Lake Miller indicating "NO FISHING OR SWIMMING IN LAKE MILLER".

*Placement of these signs was reviewed by EPA personnel and are presented in **Figure 14.** These signs are checked on a semi-annual basis in accordance with the O&M plan.*

- **Installation of signs on all sides of the groundwater treatment facility warning that it is a hazardous waste treatment facility.**

These signs were installed following construction of the system and are checked on a regular basis in accordance with the O&M plan.

- **Notification of Mr. Mills, a property owner across Lake Miller from Sherwood, that Lake Miller should not be used for fishing or swimming purposes.**

Mr. Mills was notified of the Lake Miller access restrictions following the signing of the OU-1 ROD and was reminded of this restriction during the Public Meeting for the OU-3 ROD. Mr. Mills is also verbally reminded of the restriction on a semi-annual basis in association with the sampling of monitor wells located on his property.

- **Maintenance of the security fence to discourage trespassing on the Sherwood Site property and maintenance of the current Sherwood regulations restricting employee access to Lake Miller.**

The site has been fenced since manufacturing operations at the plant began. Sherwood personnel implemented the internal restrictions of employee access to the Lake at the time that the ROD was implemented. The plant has allowed the vegetation around the lake to grow wild restricting the casual access to the lake. The condition of the fence is visually inspected for gaps during the weekly O&M of the groundwater recovery and treatment system by the O&M Contractor. The O&M Contractor notifies the plant environmental coordinator on a bi-annual basis of the continuing restriction of employee access to the lake.

- **Requirement that Sherwood notify FDEP and EPA of plans to excavate soils, demolish buildings, or remove pavement. Soils exposed as a result of these activities will be required to meet TCLP criteria or contain less than 520 mg/kg of chromium to remain on-site untreated.**

This requirement was implemented with the acceptance of the ROD. The O&M Contractor observes the site for signs of excavation during the weekly O&M of the groundwater recovery and treatment system. The plant environmental coordinator also

notifies the O&M Contractor of any planned excavations at the site. This notification includes the proposed location and depth of the excavation.

Should an excavation at the site be noted by the O&M Contractor or should the O&M Contractor be notified by the plant of a planned excavation, the O&M Contractor provides a letter to the plant manager stating the requirements of the ROD and seeking coordination of the plant environmental coordinator in the sampling of the excavated soils. A letter is also prepared for the EPA and the FDEP notifying them of the planned or discovered excavation as well as the plan for the collection of soil samples.

Upon identification of an on-site excavation or upon receipt of notification of a proposed excavation, soil samples are collected from those soils proposed to be excavated. If samples are to be collected prior to the initiation of an excavation, samples from the maximum proposed depth of the excavation are collected.

Each soil sample is analyzed for total chromium utilizing EPA method 7190 or EPA Method 6010. If the sample analysis indicates that the chromium concentration in the sample exceeds the limit established in the ROD (520 mg/kg) the laboratory is instructed to perform a TCLP test on the sample for chromium utilizing EPA Methods 1311/6010.

Upon receipt of the soil sampling analysis, the designated AHPC Superfund Project Coordinator notifies the EPA and the FDEP of the sample results. The letter is accompanied by a map showing the sample collection locations and copies of the laboratory analytical report.

If any sample exceeds the ROD criteria for chromium (520 mg/kg) or fails to pass TCLP criteria, preventative or corrective action is taken. If the sample was collected from an existing excavation, the excavated soils is considered a waste and shipped off-site for disposal. If the sample was collected from the area of a proposed excavation, the plant environmental coordinator is notified and the location of the proposed excavation is moved if possible. If it is not possible to move the location of the excavation, The O&M Contractor works with the plant environmental coordinator to limit the amount of soil which

must be excavated. Excavated soil is further sampled and characterized and that which does not meet the criteria set forth in the ROD should be shipped off-site as a waste.

- **Requirement that the Sherwood Site remain an industrially zoned area or address elevated contaminant levels in all environmental media at the site such that the site does not pose a threat to human health and the environment as defined by EPA and FDEP.**

  This requirement has not been met. AHPC personnel are developing the necessary restriction notifications which should be filed with the local property appraisers office by years end.

3.2.2 Lake Miller Sampling

The ROD for OU-3 required the completion of a single fish tissue sampling event and the implementation of the semi-annual sampling of sediments and surface waters from Lake Miller. The implementation of this remedy has been incorporated into the O&M plan and a Work Plan for the action is under development. This action is scheduled to begin in the 1st quarter of the year 2000.

3.3 Operation and Maintenance Requirements

As a part of the 5-year review process the current O&M Manual and the Performance Standard Verification Field Sampling and Analysis Plan were reviewed to determine what the planned O&M activities for the site were. As a result of this review, a new O&M plan was developed and implemented on May 15,1999.

The following is a summation of the selected remedy as installed and the O&M activities as originally designed.

3.3.1 System Components

Groundwater Extraction Wells

A total of 9 extraction wells were originally installed at the site to collect groundwater from the surficial aquifer and pump the water to the air stripper. Each extraction well was installed into the top of the identified clay layer. Extraction well depths ranged from 38.5 feet to 59 feet below land surface. Each extraction well is constructed with either 20 or 30 feet of screen depending on the thickness of the saturated zone. Each well was equipped with a fixed capacity submersible pump. The capacity of the pumps were determined during the groundwater modeling effort associated with remedy development during the remedial design. All wells are set in subsurface vaults constructed with the top 1-foot sticking up above the ground. Well control electronics are mounted on the side of each vault. Water pumped from each well exits the vault through a 2-inch PVC discharge line. Each discharge line is equipped with a flow-control valve, a sampling port, a line pressure gauge and a flow meter. Discharge lines from extraction wells EW-1 through EW-6 are manifolded into a single 4-inch line. Discharge lines from extraction wells EW-7 through EW-9, when they were operational, were manifolded into a second 4-inch line. These lines converge into a 6-inch line which enters the air stripper. All discharge lines, electric lines and control wiring is buried at the site.

It should be noted that wells EW-7 through EW-9 have been taken out of service but the well casings, wiring and piping remain intact should the installation of pumps again be necessary.

All recovery systems were visually inspected on a daily basis as a part of the overall facility inspection. Repairs to the system were made when system components broke down or when recovery rates significantly were reduced.

All recovery wells and associated vaults and controls are now inspected on a weekly basis in accordance with the O&M plan. All recovery pumps are cleaned quarterly to remove mineral and biological deposits.

Air Stripper

The air stripper consists of a 5 ft diameter freestanding fiberglass tower with a total height of 32 ft, a 740-scam (standard cubic feet per minute) centrifugal air blower, and 23 ft of polypropylene Jaeger Tripack packing. A total of nine extraction wells have been installed that will lower the groundwater table and pump groundwater containing VOCs to the air stripper for removal of the VOCs. Three of these wells (EW-7 through EW-9) have been taken out of service. A magnetic flow meter with a recorder and totalizer measures the influent groundwater flow rate to the stripper. The discharge of treated ground water from the air stripper occurs by gravity through a 6 inch diameter PVC pipeline. This discharge line contains a sampling port to obtain air stripper effluent samples. The air stripper blower inlet duct contains a flow switch that shuts down all of the well pumps if air flow stops. A liquid level switch also shuts down all of the well pumps if the liquid level in the air stripper sump rises above a certain high-level point. The Programmable Logic Controller (PLC) in the central control panel is programmed to operate the air stripper with the above control requirements.

The air stripper column includes a differential pressure gauge. This gauge is inspected weekly to assess whether there is a buildup of biological materials on the stripper packing. If these inspections show a gradual increase in the pressure across the column prior to a scheduled stripper media cleaning, the O&M Contractor will shut down the entire system so that the stripper packing may be cleaned. An intermittent chlorination system was installed (as discussed in the next subsection) to add chlorine to the stripper influent and thereby prevent biological growth. As part of the routine maintenance of the air stripper, periodic inspections of the fan, motor, belts, motor control alarms and interlocks, wetted parts, nozzles, etc., are conducted to assess whether replacements are necessary.

Under the new O&M plan, the airstripper and its controls are checked on a weekly basis and the stripper media is cleaned in-situ on a monthly basis.

Chlorination System

Chlorine is fed to the air stripper influent line in the form of a sodium hypochlorite solution. A metering pump feeds a preset amount of the solution from a drum container. The metering pump operates on a timer that is linked to the PLC on the central control panel. The PLC is programmed to operate the timer such that sodium hypochlorite was added for 15 minutes after a certain (total) flow had passed. If there was no influent flow, the time was locked out from starting the metering pump. The level of the sodium hypochlorite solution remaining in the drum is determined by means of a dip rod.

Discharge Pipe to Lake Miller

The treated water from the air stripper is discharged by gravity via a 6 inch PVC pipe to Lake Miller. The end of this discharge pipe has a 4 inch discharge nozzle (single port diffuser) for dispersion of the effluent. The discharge system is inspected as a part of the weekly system O&M activities.

3.3.2 Overall System Maintenance Guidelines

The primary objective of the remediation facility is ground water capture via the wells and effective drawdown is achieved, and that the remediation system is properly operating and meeting the guidelines specified by EPA. Presented below is a list of guidelines to maintain the remediation system and which have been incorporated into the O&M plan. This provides for efficient operation of the system on a routine basis:

- The desired quality in the effluent discharged to Lake Miller is maintained through the proper operation of the air stripper. The recommended maintenance schedules are available in manuals provided by vendors of the different pieces of equipment. These manuals are available on-site.

- The lowest cost per gallon of ground water treated is achieved. This requires efficient operation of the system and regular maintenance.

- Equipment systems will be properly and routinely maintained to lengthen their useful life and to reduce downtime.

C Accidents and injuries will be prevented. The O&M Contractor understands the dangers associated with each piece of equipment and with each chemical system. Material Safety Data Sheets (MSDS) for each chemical used in the treatment facilities will be filed on-site. The O&M contractor must be trained, by using all of the above information, to properly operate and maintain the groundwater extraction and treatment system and thereby minimize the potential for accidents and injuries.

3.3.3 System Inspection

The pumping and collection system is inspected on a monthly basis to ensure that the systems were properly functioning, that leaks had not developed, and that component deterioration that could jeopardize system operation had not occurred. This inspection was to include a visual check of the conveyance and collection lines, the control valves, the discharge line pressure, and the circuit breakers at the main panel. All deficiencies are to be noted and corrected.

The treatment system was to be inspected on a daily basis for proper operation in accordance with equipment vendor specifications. Visual checks of the chlorination feed system and the packing condition in the stripper were to be performed on a daily basis. All deficiencies were to be noted and corrected.

Both the extraction and treatment systems were to be inspected after an extreme climate event that may have impaired the operation of the systems to ensure that they were functional. Damage occurring during such an event was to be repaired as soon as practical.

Under the new O&M plan the O&M Contractor visits the site on a weekly basis to perform a full system visual inspection. Pump rates and other system operational parameters, including the operation of the water supply well stripper are checked and recorded. The air stripper is backwashed on a monthly basis and all extraction well pumps are pulled and cleaned on a quarterly basis. All O&M details and procedures are presented in the O&M plan.

3.4 O&M Activities

As a part of this 5-year review, O&M records for the OU-1 treatment system have been reviewed and site personnel were interviewed to determine compliance with the requirements developed at the implementation of the remedy and contained in the original O&M plan.

Sherwood maintenance personnel conducted the O&M of the system. A walkover and visual inspection of the system was completed at the start of each working day. This inspection was completed as a part of the overall daily plant inspection and no records of system parameters were kept on a daily basis. When a problem occurred with the system a verbal report was made to the plant environmental coordinator who was responsible for taking appropriate action. Most system repairs were completed by plant personnel. System repairs typically involved the replacement of flow meters, repairs to electronics and the repair of systems when the air stripper was struck by lightning. While it is known these actions occurred over the years, documentation of these actions is not a part of the site system records, although some are contained in facilities maintenance records.

Due to declining recovery rates from the extraction wells it was reported that plant personnel attempted on two occasions to clean the extraction wells. This process included the removal of groundwater pumps and the swabbing of the well casing and screen. This action resulted in increased recovery well production, but the results were femporary. The dates of these actions was not recorded by plant personnel.

Due to continued decline in production rates, the extraction system was rehabilitated during the week of February 24,1997 under subcontract to an outside consultant. This rehabilitation included the removal, dismantling and cleaning of all recovery pumps, acid washing of the recovery well sand filter pack, aggressive redevelopment of the wells through pumping and surging and the cleaning of all control components.

In conjunction with the cleaning of the recovery system the air stripper was also rehabilitated under subcontract to an outside consultant. This action involved the opening of the stripper tower and the removal and replacement of all stripper media. All system components were also cleaned at this time. Subsequent to this action, a stripper recirculation system was installed in July, 1997.

This system allowed for the acid wash of the stripper media while still in the stripper tower. Piping was installed which allowed the wash water to be discharged directly to the IWTP where it was treated.

3.5 Estimated Time Required for Remediation

As stated in **Section 3.1.1.1**, groundwater velocity across the site under pumping conditions was calculated to determine the amount of time required for groundwater to be intercepted by the extraction well field. Under ideal conditions, groundwater located upgradient across the Site from Lake Miller would require approximately 3 years to travel the 1,400 feet to reach the extraction well field and be intercepted. One rule of thumb for estimating the time required to cleanse aquifer materials of contaminants is that 3 pore volumes of the aquifer material must be exchanged to allow for removal of contaminants from the material. Based of the flow rate presented above and the occurrence of contaminants near the upgradient extent of the site, it can be estimated that the remedial action will require at least 15 additional years to achieve the cleanup goals. This estimate does not take into account the potential for a DNAPL source or continued flushing from a potential source in the vadose zone which would continue to feed the dissolved plume, extending the time required for remediation. This estimate also does not take into account the natural attenuation of the contaminants occurring at the site which may shorten this estimate.

3.6 Progress Since the Last Review

This section is not applicable as this is the first review for the site.

4.0 Five-Year Review Findings

This section presents the major findings of this review.

4.1 Five Year Review Process

The 5-year review of the Sherwood Medical Industries site was conducted by American Home Products Corporation in cooperation with the United States Environmental Protection Agency and the Florida Department of Environmental Protection. The primary objectives of the review were to determine if the implemented remedy and the remedial action objectives continued to be protective of human health and the environment. Activities completed during this process included:

Document Review

Documents, reports and files relevant to the initial remedial investigation, the selection of the operating remedy, the proposed plan and ROD, operation and maintenance of the selected remedy and continued monitoring of the effectiveness of the remedy were reviewed at the start of the process. All documents were kept on file at the site and copies were made of those documents which needed to be removed from the site. The purpose of this review was to identify site cleanup criteria, establish baseline conditions at the site at the implementation of the selected remedy and to document the effectiveness of the remedy over the review period. A list of site specific documents reviewed is presented in **Table 3** of this report.

Personnel Interviews

During the period of document review, site personnel were interviewed about the operation and maintenance of the selected remedy. Site personnel interviewed included the Plant Environmental Coordinator, the Plant Manager and facilities personnel responsible for upkeep of the treatment system.

Site Visit

Review personnel conducted site visits in April and May, 1998 to gather operating details on the selected remedy and to identify systems within the remedy which could be changed or updated. Areas inspected included recovery well vaults, piping runs, chemical storage areas, the air stripper location, system control boards and the system discharge piping. Notes were made as to which areas needed modification, repairs or replacement.

During this visit it was noted that the system in general was in good operating condition with the exception of the need for minor repairs. Well vaults at the site are subsurface extending approximately 1-foot above the surrounding ground. Some vaults showed signs of flooding and others showed erosional effects where water was undermining portions of the structure. Each pump discharge pipe was fitted with a flow meter. It was noted that some meters were not operating properly which may cause the system to shut down the pump erroneously. It was also noted that the two wells on the southern end of the recovery system (EW-5 and EW-6) were pumping less water than the maximum anticipated rate which resulted in lower than specified drawdown in this area. Information gathered during this visit was used to prepare recommendations for system modifications and for continued system O&M and all systems are now operating within expected tolerances.

In accordance with ROD institutional controls it was noted that site access is limited by a full perimeter fence which has two gates for entrance. One gate is kept locked at all times and is used only for the pre-approved movement of trucks and heavy equipment or large deliveries. The second gate is for general site access. This gate is manned 24-hours a day by security personnel who limit access to employees or identified contractors and visitors. Visitors to the plant are required to check in at the reception area and must be escorted when within the plant. Access to the plant property via Lake Miller has been limited by allowing shoreline vegetation to grow freely. Trees, vines and aquatic plants make access to the shoreline on the Sherwood property difficult.

As required by the ROD institutional controls, the site has been posted with signs stating that no fishing or swimming is allowed in Lake Miller and that the area in the vicinity of the air stripper is a hazardous waste treatment facility. These signs were maintained by Sherwood maintenance personnel but are now maintained under the O&M plan.

Site Status Presentation

Data gathered from the site documents review was used to prepare a summary presentation for the site. This presentation was made at the offices of EPA Region IV on May 19, 1998. A representative of the FDEP was present via conference call. The purpose of this presentation was to update regulatory personnel as to current site conditions and to preview information which would be incorporated into the 5-year review report. Data presented included site geology, suspected source locations, contaminant distribution and concentration trends, potentiometric data and site O&M data. Regulatory feedback at the meeting was used to change the presentation of some of the data and to acquire additional data as requested for inclusion in this report.

4.2 Interviews

Interviews conducted during the 5-year review were limited to Sherwood personnel associated with the implemented remedy. These personnel included the Plant Environmental Coordinator and facility maintenance personnel responsible for system O&M activities. Facility maintenance personnel had been responsible for maintaining site institutional controls including the upkeep of perimeter fencing and limiting overall site access.

Discussions with plant maintenance personnel identified minor operational problems with the implemented remedy. These problems included declining recovery well rates, increased operational pressure within the air stripper and system shutdowns associated with meteorological events. Problems associated with declining operational parameters may be the result of limited preventative maintenance on the system. Plant personnel have typically responded to problems with the system as they occurred. An O&M plan has been developed and O&M procedures have been implemented which focus on routine preventative measures designed to keep the system operating. These new procedures were implemented on May 15, 1998.

4.3 Site Visit

The site O&M Contractor, under contract to AHPC visited the site on May 11, 1998 to assess the operational status of the implemented remedy. Personnel making the inspection included a senior geologist, an electronics technician and an O&M system technician. The O&M Contractor met with Sherwood facilities personnel who were responsible for the O&M of the system and then inspected all components of the system. The O&M Contractor identified components of the system which were in need of repair or update and also collected data which would allow for the remote monitoring of the treatment system. Data collected during this visit was used to develop an O&M plan, which was implemented at the site beginning on May 15, 1998. This plan incorporates the remedy O&M requirements of OU-1 and OU-3, including groundwater, surface water, sediment and fish tissue sampling. A task summary of the revised system O&M is presented in **Section 5.4** of this submittal.

4.4 Remedial Action Objectives Review

Remedial action objectives (RAO's) are presented in the ROD for the site. These requirements were reviewed to determine if regulatory chances had occurred which may alter the required cleanup goals. The following is a presentation of the RAO's from the ROD and any significant changes which may have occurred. These RAO's apply to waters of both the sufficial aquifer and the Floridan aquifer.

4.4.1 Compliance with Applicable or Relevant and Appropriate Requirements

Section 121 (d) (2) (A) of CERCLA incorporates into the law the CERCLA Compliance Policy, which specifies that Superfund remedial actions must meet any federal and state standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate requirements (ARARs). Also included is the provision that state ARARs must be met if they are more stringent than federal requirements.

Applicable requirements are defined as cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site.

All potential ARARs used to develop cleanup goals for treating groundwater at the Sherwood site are presented in **Section 4.4.1.1.** Where VOCs and inorganic compounds affect groundwater, the Safe Drinking Water Act (SDWA) provided potential ARARs for establishing cleanup goals, i.e., Maximum Contaminant Levels (MCLs). In addition, the State of Florida has established MCLs under Florida Administrative Code (FAC 62-550) for specific contaminants, which, when more stringent than federal MCL, have been selected as the cleanup goals for this project.

All ARARs were reviewed during the preparation of this report. A listing of the established cleanup goals based on the identified ARARs for the site are presented in **Section 3.1.4** of this document. These criteria have not changed since the implementation of the remedy. The implemented remedy was found to meet or exceed the following ARARs which remain applicable at the time of this review.

Clean Water Act (CWA) / Safe Drinking Water Act (SDWA)

The Safe Drinking Water Act (40 C.F.R. §§ 141, 142 and 143) specifies the MCLs for groundwater containing chromium. However, the State drinking water standard under Florida Administrative Code (FAC) 62-550, for VOA's (PCE, TCE, DCE and vinyl chloride) were found to be more stringent and were therefore adopted as the cleanup goals for these compounds. The cleanup goal for acetone was established based on the State of Florida Groundwater Guidance Concentration.

The Clean Water Act ((40 C.F.R. §§ 122-125) specifies the substantive requirements of the national Pollutant Discharge Elimination System (NPDES). The treatment system meets the substantive requirements of the NPDES program but does not require a permit as it is an on-site action. Discharge requirements for the treated groundwater (VOC's) are identical to the State of Florida drinking water standards.

Florida Administrative Code (FAC) 62-550

FAC 62-550 establishes chemical concentrations acceptable in potable water. These standards in the case of VOA's are more stringent than the federal MCL and were therefore established as the cleanup goals.

Florida Administrative code Chapter 62-302

FAC 62-302 establishes effluent limitations and operating requirements for surface water discharge. This requirement is applicable and has been used to establish the discharge criteria from the treatment system.

Florida Administrative Code Chapter 62-736

FAC 62-736 requires that warning signs be placed on all sides of the groundwater treatment facility with the warning that there is a hazardous waste treatment system present. FAC 62-736 was repealed, but the requirement for warning signs was incorporated into FAC 62-730 (Hazardous Waste Rule).

Florida Groundwater Guidance Concentrations

These are health based guidance concentrations developed using EPAs Integrated Risk Information systems. The cleanup goal for acetone is based on this guidance.

4.5 Data Review

All relevant and appropriate documents associated with the site investigation, remedy development and remedy operation were reviewed during the development of this report. The goals of this review were to provide an overview of the site geology and hydrogeology in relation to the selection of the remedy and to document the effectiveness of the remedy in reducing concentrations of the chemicals of concern in the groundwater.

4.5.1 Site Geology

One of the focuses of the remedial investigation (February 1990 through March 1991) at the site was to determine site specific geology and hydrogeology to aid in the design of the selected remedy and collect soil samples for chemical analysis. The RI investigation was accomplished through the completion of 45 soil borings and 4 core sample borings and the installation of 14 surficial aquifer monitoring wells and 5 deep monitoring wells. Soil boring and core boring locations are presented on **Figure 3** and soil boring data is tabulated in **Table 4**.

Soil borings ranged in depth from 2-ft to 62-ft. Six borings encountered a clay layer at depths ranging from 23 to 49-ft below land surface. This clay was described as a gray-green/green cohesive, plastic clay. One soil boring penetrated the clay (SB-41) and found it to be approximately 10-ft thick.

Core sample borings were deeper ranging in depth from 50-ft to 100-ft. All core sample borings encountered the clay and three of the borings penetrated the clay, determining its thickness to be between 5 and 8-ft thick. Undisturbed samples of the clay were collected to measure to the ability to prevent migration of surficial waters to the Floridan aquifer. Two of these borings also encountered the limestone bedrock at depths of 93 and 101-ft.

Additional borings were completed for the installation of 14 sufficial monitoring wells, 5 deep monitoring wells and 9 groundwater extraction wells. Monitoring and extraction well locations are presented on **Figure 4** and data is tabulated in **Tables 5 and 6.**

The soil boring and well installation program established the presence and continuity of a confining clay layer upon which the surficial aquifer lies. This layer was encountered in several of the soil borings and in the installation of all surficial monitoring wells. Data collected during the boring program was used to create a generalized isopleth map of the top of the clay (**Figure 5**). Most notable on this map is the presence of a low trend in the clay in the vicinity of Lake Miller. To better illustrate the relationship between the surficial aquifer and the clay layer three cross-sections were developed. Cross-section locations are presented on **Figure 6** and the cross-sections appear as **Figures 7, 8 and 9.**

Cross-section A-A' (**Figure 7**) runs north-south along the leading edge of the plume and shows the continuity of the clay layer and also illustrates the dip in the clay layer. As clays are typically deposited horizontally in a marine environment, the presence of the dip in the layer at this point may signify the presence of a sink or solution feature below the clay which has not yet breached the clay layer. This depression is reflected on the topographic surface as Lake Miller.

Cross-section B-B' (**Figure 8**), which runs north-south adjacent to Keplar Road does not reflect this depression in the clay. Cross-section C-C' (**Figure 9**) runs east-west and terminates within Lake Miller. This diagram illustrates this the slope of the clay layer near of Lake Miller.

Water elevations are presented on each of the cross-sections and arrows indicate the flow of water across the site and, in the vicinity of the extraction wells, into the recovery system.

4.5.2 Potentiometric Surface

Water levels have been collected in conjunction with the collection of groundwater samples through out the operational period of the implemented remedy. Water elevations recorded since June, 1995 are presented in **Table 7** and a potentiometric map depicting water elevations in the surficial aquifer on October 5, 1999 is presented as **Figure 10**. As only a few data points in the Floridan aquifer have been monitored during this investigation a potentiometric map of this zone can not be produced. As shown in **Figure 10**, groundwater flow in the surficial aquifer is generally to the southwest across the site towards Lake Miller where it encounters the cone of depression created by the groundwater extraction system.

4.5.3 Contaminant Estimates

As a part of this review, an attempt was made to estimate of the contaminant mass in the groundwater at the start of the remedial action was calculated. To calculate this mass, a contaminant isopleth map was produced for PCE, TCE and DCE utilizing data collected from a sampling event (April, 1991) completed prior to the start of operation of the groundwater recovery and treatment system. The surface area within each isopleth was then calculated and, assuming an average water column thickness of 30 feet, a volume within each contour could be calculated. This volume was converted to gallons, assuming an average site porosity of 30%, and the volume was assumed to contain the average contaminant concentration between the isocontours

(everything between 200 and 300 would be 250). Each inner contoured volume was subtracted from the volume as a whole to create a series of "doughnuts" containing a volume of groundwater at a given contaminant concentration. This was done so as not to double count volumes of water. Using the average concentration of each section, the mass of contaminant could then be calculated. This calculation does not take into account continuing addition of contaminants to the dissolved phase from DNAPL sources or from percolation from the vadose zone. This calculation could not be completed for the Floridan aquifer due to the limited points defining the plume. Based on this process, the following contaminant mass was estimated:

- PCE 411 pounds
- TCE 36 pounds
- DCE 7 pounds

It should be noted that this estimate is low and that an estimate of contaminant recovered (Section 5.4 and Table 8) exceeds by five times the estimate for PCE at the start of the implemented remedy. This under estimation of the contaminant mass at the start of cleanup is due primarily to the limited number of data points (14) scattered over such a wide area. These limited points served only to define the extent of the plume but were never intended to delineate the plume on such as scale as to be able to accurately determine the contaminant mass. Areas of elevated contamination concentrations are within the aquifer and are being recovered, but can only be quantified when the plume is situated at a monitoring point on one of the two days a year on which a sample is collected. During the operation of the recovery system, it has been noted that the contaminant concentration rose in some wells during the initial period of operation. As an example, the PCE concentration in well MW-106 was 1,600 ug/I in April, 1991, which was the basis for the mass estimate. This concentration rose steadily and peaked at 6,130 ug/I in December, 1995. Since that time the concentration has dropped, but remains at 2,800 ppb.

4.5.4 Concentration Trends

The ROD identified 6 chemicals of concern (COC's) which must be addressed during the cleanup. The implemented remedy includes active remediation of the surficial aquifer through a groundwater recovery and treatment system and also requires that Sherwood continue to operate the on-site water supply well, which is also then treated, to address VOCs in the Floridan aquifer. The following presents the current status for each of the COC's and also makes note of trends where apparent. Historic analytical results (beginning in 6/94) are presented in **Table 8** and **Illustrations 1 through 8**.

4.5.4.1 Chromium

During the remedial investigation, chromium was detected above criteria only in the surficial aquifer. Therefore the ROD lists chromium as a COC in the surficial aquifer only and has established a cleanup goal of 100 ppb. Chromium has been used in the production in the plant and sodium dichromate was used in treating cooling water. Elevated chromium was detected in soils at the site. The highest chromium concentrations in the surficial aquifer were detected in April 1990 when a sample from well MW-107 contained 410 ppb and a sample from well MW-108 contained 430 ppb. As shown in **Table 8**, chromium concentrations have dropped over time and the highest concentration detected in June, 1999 was 86 ppb (MW-112). The last exceedance was December, 1998 when chromium in well MW-112 was above the criteria.

4.5.4.2 Acetone

Acetone was not identified as a chemical used in any operations at the Sherwood facility and releases of the chemical maybe associated with the former boat manufacturer which occupied the property. The ROD sets a cleanup goal of 700 ppb. Acetone was detected in the surficial aquifer in May, 1989 when a sample collected from well MW-105 contained 770 ppb. Acetone has not been detected in any recent (back to 6/95) sample collected from the surficial aquifer.

Acetone at the site has been a concern within the Floridan aquifer. The highest concentrations detected within the groundwater occurred in samples collected from SMFA-2 (51,000 ppb in 1990) and from SMFA-3 (77,000 ppb in 1991) and the compound has been detected in lower concentrations (<100 ppb) in the off-site Floridan wells. The SMFA wells were formerly old water wells completed into the upper Floridan Aquifer. It was determined that the casings of these wells

had corroded, allowing waters from the surficial aquifer to enter the Floridan aquifer. These well casings were sealed and the wells were turned into monitoring wells at the start of the remedial investigation. Concentrations of acetone detected in the Floridan aquifer had dropped since the beginning of the remedial actions and only 1 sample (SMFA-2, 1,950 ppb in 12/95) collected since June 1994 had exceeded the cleanup goal. Two samples collected in June, 1998 showed a sharp increase in acetone concentrations. The sample collected from well SMFA-1 had a concentration of 1,700 ppb, an increase from 16 ppb the previous sampling, and the sample collected from SMFA-2 had a concentration of 1,100 ppb, up from 43 ppb. Both of these wells were sampled in December, 1998 and in June, 1999 as a part of the continuing groundwater monitoring program. The concentration of Acetone in well FA-1 dropped to below the detection limit (50 ppb) in June, 1999 while the concentration in well FA-2 had dropped to 240 ppb. A provision has been added to the O&M plan to allow for confirmation sampling of either of these wells should concentrations above the cleanup criteria (700 ppb) again be detected. If elevated concentrations remain in the confirmation sampling results, AHPC will notify the EPA and the FDEP of the finding and schedule a meeting to determine the appropriate course of action.

4.5.4.3 1,2-dichloroethene (DCE)

The ROD has established a cleanup goal of 3 ppb for this compound. The ROD did not differentiate between cis-1,2-DCE and trans-1,2-DCE and the two have historically been added together when presenting site data. **Table 8** of this submittal has been reformatted to break out the two compounds for trend analysis as cis-1,2-DCE typically reflects the biological degradation of TCE and PCE reflecting the natural attenuation of the plume.

DCE (combined) has been detected in the surficial and the Floridan aquifer above the remedial goal while detections in waters of the Floridan Aquifer have been limited to the two water supply wells (SMSW and SMFW) and the two of the converted water wells (FA-1 and FA-2). No DCE has been detected in the off-site Floridan wells or in any of the residential wells.

In the surficial aquifer, DCE is typically detected as the breakdown product cis-1,2-DCE in the downgradient wells (MW-102, MW-103 and MW-104) along the leading edge of the plume. The combined concentration in well MW-105, also at the leading edge of the plume, has risen from 30 ppb in June, 1996 to 615 ppb in June 1999 of which 600 ppb is of the cis-1,2 variety. The chemical

was detected for the first time in well MW-107 in December 1997 and was also detected in well MW-106, although elevated detection limits may have been masking the occurrence since it was originally detected in December 1994.

The detection in the Upper Floridan well FA-1 (31 ppb in June 1999) also occurs primarily as the breakdown product cis-1,2-DCE (29 ppb in June, 1999). The combined compound was detected in well FA-2 above the cleanup goal between June, 1994 and June, 1995. It continues to be detected in this well at a concentration of 1.4 ppb in the breakdown form.

The detections in the Lower Floridan site supply wells (SMWS and SMFW) have been continuous since June, 1994 and occur primarily in the breakdown form.

DCE was not a compound with a record of usage at the plant. The detection of the compound along the leading edge of the plume, in some of the site's most historically impacted wells, and its detection in areas where it was not previously detected may be an indicator that the main site chemicals of concern (PCE and TCE) are biodegrading naturally as the plume matures.

As the detection incidence of combined DCE has increased, there are now sufficient monitoring points to prepare an isopleth map of the compound in the surficial aquifer. This data has been plotted on a map depicting the drawdown of the recovery system. As seen in this figure (**Figure 11**), the plume is localized in the vicinity of the extraction system and at the center of the plant area. The plume, as drawn, is within the capture zone of the treatment system.

4.5.4.4 Vinyl Chloride

Vinyl chloride is another compound which has no record of usage at the plant and is thought to be a degradation product of TCE and PCE. The ROD has established a cleanup goal of 1 ppb. Vinyl chloride has been historically detected in two surficial monitoring wells along the leading edge of the plume (MW-103 and MW-105) and in three extraction wells (EW-2, EW-4 and EW-5). The compound has also occurred on four occasions in the Upper Floridan well FA-1 (maximum concentration 7.4 ppb) which also contains the degradaded form of DCE and in the Upper Floridan well FA-2 (December 1994) at a concentration of 1.6 ppb.

The detection in the deep aquifer water supply well (SMWS) in June 1996 at a concentration of 0.95 ppb was the first detection in the Floridan aquifer. It has subsequently been detected three additional times in SMWS and once in SMFW at a concentrations below the Practical Quantitation Level (PCL).

This compound was not detected in the off-site Floridan wells or in any of the residential wells.

4.5.4.5 Trichloroethane (TCE)

TCE has been a persistent chemical of concern at the site. The highest concentration detected at the site was 555 ppb in MW-102 in June 1993 and the ROD has established a cleanup goal of 3 ppb. TCE has been continuously detected in the Upper Floridan aquifer (since 6/94) in well FA-1 which, as described in the preceding sections, also contains the breakdown products cis-1,2-DCE and vinyl chloride. This compound has also been detected in both water supply wells (SMWS and SMFW) in every sampling event except once since June, 1994. Peak concentration in the Floridan occurred in September 1991 with a concentration of 130 ppb in well SMFA-1. This compound was also detected in concentrations below the cleanup goal in the Lang residential well prior to the destruction of the well in 1996. A work plan is being developed to install a deep monitoring well at this location to determine if this compound is still present in the Floridan aquifer.

TCE has occurred in sufficient quantities and is widely enough dispersed in the surficial aquifer that a contaminant isopleth map (**Figure 12**) has been created and concentration trends have been illustrated on the accompanying **Illustrations 1** through **4**. As shown in **Figure 12**, the highest concentrations of TCE occur along the leading edge of the plume and throughout the center of the plant in lesser concentrations. A small plume also appears to have entered the southeastern portion site from an upgradient location. With the exception of these newly detected concentrations of TCE the plume appears to be within the capture zone of the existing treatment system.

In illustrating the concentration trends, the wells have been grouped into 4 categories; upgradient wells, perimeter wells (those which define the sides of the plume), “Hot” wells where the highest concentrations had been detected in the past, and the “other” wells which define concentrations within the plume and along the leading edge of the plume. As shown in these illustrations, concentrations dropped sharply after the implementation of the selected remedy and have reached

a steady state with some upward and downward fluctuation. The exceptions to this are wells MW-104 and MW-105 which are located along the leading edge of the plume. Concentration increases in these two wells, along with associated increases in other chemicals of concern detected in these wells, may signify the migration to the extraction system of elevated concentrations of contaminants from the main plume area or contamination which had passed the area prior to the installation of the recovery system which is now being drawn back to the point of recovery.

4.5.4.6 Tetrachloroethene (PCE)

PCE has been the remedial driver at the Sherwood site as the concentrations of this compound have been consistently higher than those of any other COC. The ROD has set a remedial goal of 3 ppb for this compound. PCE was originally detected in both site water supply wells (SMWS and SMFW), but neither well has shown a detected concentration since December 1997. This compound has been detected in the Upper Floridan well FA-1 on one occasion at a concentration of 400 ppb in September 1991.

This compound was also historically detected in concentrations below the cleanup goal in the Lang residential well and exceeded the cleanup goal (at a concentration of 3.13 ppb) in June, 1996 prior to the destruction of the well in the latter portion of 1996. A work plan is being developed to install a deep monitoring well at this location to determine if this compound is still present in the Floridan aquifer.

Like TCE, PCE has occurred in sufficient quantities and is widely enough dispersed in the surficial aquifer that a contaminant isopleth map (**Figure 13**) has been created and concentration trends have been illustrated on the accompanying **Illustrations 5** through **8**. As shown in **Figure 13**, the highest concentrations of PCE occur along the leading edge of the plume and at the center of the plant (MW-106) where it occurs at a concentration of 2,800 ppb (6/99). The compound also occurs in lesser concentrations throughout the property. A small plume of PCE has also appeared at the southeastern portion site from an upgradient location. With the exception of these newly detected concentrations of PCE the plume appears to be within the capture zone of the existing treatment system.

In illustrating the concentration trends, the wells have once again been grouped into 4 categories; upgradient wells, perimeter wells (those which define the sides of the plume), "Hot" wells where the highest concentrations had been detected in the past, and the "other" wells which define concentrations within the plume and along the leading edge of the plume. As shown in these illustrations, concentrations dropped sharply after the implementation of the selected remedy although there is a lot more fluctuation in the source area wells and in upgradient well MW-108. It can be noted that the fluctuations occurring in the PCE concentrations mirror those seen in the TCE concentrations in the same wells. No connection between these fluctuations and water elevations was noted.

As was the case with TCE, the exceptions have been wells MW-104 and MW-105 which are located along the leading edge of the plume. Concentration increases in these two wells, along with associated increases in other chemicals of concern detected within these wells may signify the migration to the extraction system of elevated concentrations of contaminants from the main plume area or contamination which had passed the area prior to the installation of the recovery system which is now being drawn back to the point of recovery.

4.5.4.7 Plume Degradation

Of the 4 volatile chlorinated COC's at the site (PCE, TCE, DCE and vinyl chloride), only PCE and TCE are documented to have been used by Sherwood or previous tenants of the property. Studies have shown that chloroethenes break down in the natural environment, transforming from PCE to TCE to DCE to vinyl chloride. While the natural degradation of a chemical is usually thought to be beneficial in the eventual cleanup of a site, the chlorinated breakdown process may yield compounds which become more hazardous to human health and the environment with each degradation.

The contamination at the Sherwood site seems to be following this breakdown pattern. As the primary chemicals of concern mature within the plume, concentration increases are noted for DCE and vinyl chloride. The appearance of these compounds in the surficial aquifer has been along the leading edge of the plume, which would be the oldest portion of this plume.

Summary of Degradation Processes that Act on Chloroethenes in Ground Water: Each of the volatile chemicals associated with the site are known to biodegrade under natural environmental conditions. Vogel *et al.* (1987) reviewed the environmental transformations of the chlorinated aliphatics prevalent at the site. They found that the more chlorinated the compound, the more likely it was to biodegrade anaerobically through removal of chlorine atoms (dechlorination). Thus, tetrachloroethene (C_2Cl_4) degrades to trichloroethene (C_2HCl_3) which degrades to dichloroethenes ($C_2H_2Cl_2$) which degrade to vinyl chloride (C_2H_3Cl) under anaerobic conditions. However, each dechlorination step is slower than the previous one, so dichloroethenes and vinyl chloride would tend to "build up" over time under anaerobic conditions. This pattern is presented in **Illustration 11**, showing the loss of trichloroethene and buildup of dichloroethenes and vinyl chloride overtime, starting with a source of "pure" trichloroethene. This graph shows that, over time, dichloroethenes and vinyl chloride become the predominant chloroethenes, even though the original source contained only trichloroethene. This pattern occurs in anaerobic environments.

The less chlorinated compounds, the DCEs and vinyl chloride, are more likely to degrade under aerobic conditions. Under aerobic conditions the transformation products are not other chloroethenes, but rather organic acids, alcohols, and inorganic end products such as carbon dioxide.

EPA (1997) emphasizes and clarifies the role of various constituents of groundwater that may affect the transformation and degradation of chlorinated solvents. Their thorough review, although generally consistent with Vogel, *et al.* (1987), emphasizes the role of electron donors (reducing agents, e.g., dissolved organic carbon) that are essential to microbial dechlorination of solvents; and the variety of electron acceptors (in addition to and in competition with the chlorinated solvents) that exist in natural groundwater. Dissolved organic carbon may be present in groundwater from natural organic matter or pollutants such as landfill leachate or petroleum hydrocarbons. On the other hand, natural electron acceptors, such as nitrate, ferric iron, and sulfate, may compete with the chlorinated solvents as a potential reactant with the dissolved organic matter.

Site-Specific Considerations: Ground water in the surficial aquifer at the Sherwood site is expected to be aerobic. Most water table aquifers contain dissolved oxygen (DO) in the range of 1 to 8 mg/L. BTEX constituents, as well as other petroleum hydrocarbons that could act as electron donors, do not occur in significant concentrations in the affected portion of the surficial aquifer. The aquifer is fed by recharging rainwater, which would contain ~ 8 mg/L. Although organic matter in surficial soils may reduce DO somewhat, the soils at the site are expected to have moderate levels of organic carbon and are unlikely to reduce DO levels in the aquifer below 1 mg/L.

In an aerobic surficial water table aquifer, reduction of PCE and TCE to DCEs and vinyl chloride is expected to proceed slowly. Further, any DCEs and vinyl chloride produced would not be expected to persist, and it is expected that PCE and TCE would be the predominant chloroethenes present in ground water. This hypothesis is supported by the relative levels of parents, PCE and TCE, to potential daughter products, DCEs and vinyl chloride. In the June, 1994, sampling event, PCE averaged 1100 µg/L (6.6 µmole/L) in the fourteen surficial aquifer monitoring wells; TCE averaged 52 µg/L (0.40 µmole/L); DCEs averaged 36 µg/L (0.37 µmole/L); and vinyl chloride averaged 21 µg/L (0.33 µmole/L). On a molar basis, PCE comprised 86 % of the chloroethenes, TCE 5 %, DCEs 5 %, and vinyl chloride 4 % of total chloroethenes. The ratios (PCE : TCE : DCEs : vinyl chloride) observed at the site indicate an aerobic environment with relatively low rates of dechlorination. At sites with high levels of electron donors, including sanitary landfills and sites where chlorinated solvents were used for degreasing and are co-disposed with petroleum residues, it is not uncommon to find DCEs and vinyl chloride comprising more than 50 % of total chloroethenes. At such sites ground water DO levels are usually low, electron donors are plentiful, and dechlorination proceeds more rapidly, while DCEs and vinyl chloride are less likely to be oxidized after they are generated.

Illustration 11 shows how the ratios of the chloroethenes have changed over time in the surficial aquifer. All 14 monitor wells were averaged and the molar fraction of total chloroethenes were calculated. Samples below the detection limit were included at ½ the detection limit. Vinyl chloride and DCEs were detected infrequently in all sampling events, so their true concentrations are somewhat uncertain. **Illustration 12** indicates the expected pattern of increasing relative amounts of less chlorinated species over time. PCE as a fraction of total chloroethenes decreased from 86 % to 65 %, while the fraction of both TCE and DCEs increased. The fraction of vinyl chloride

appeared to be stable, but this may be an artifact of the averaging method and low frequency of detection.

The effect is more pronounced at the wells downgradient of the extraction wells, between the extraction points and Lake Miller. Relative composition of the chloroethenes of wells 101 through 105 and 112 are shown in **Illustration 13**. PCE declined from 88 % of total chloroethenes in 1994 to 50 to 52 % in 1998-1999, while DCEs increased from 5 % to more than 20 %.

These relative composition changes at monitor wells are probably not due solely to degradation during the period 1994 to 1999. Instead it is likely that part of the apparent increase in relative amounts of less chlorinated species is due to the effect of the extraction system drawing “older” portions of the contaminant plume back toward the monitoring locations. It is difficult to quantify the relative effects of plume contraction versus actual biodegradation during the 1994 - 1999 period.

Likewise, it is not possible to quantify the role of biodegradation in organic-rich Lake Miller sediments from available data, although the fact that the relative composition of chloroethenes in Lake Miller sediments was similar to the relative composition in the aquifer in 1994 suggests that this hypothetical process may not be a critical factor at the site.

Available data are not sufficient to quantify the rates of biodegradation in the aquifer, nor to support an accurate estimate of the period of time that the current extraction system must be operated to reach groundwater quality targets. It may be useful to analyze groundwater at the site for a diverse suite of water quality parameters recommended by EPA (1997) for evaluation of natural attenuation of chlorinated solvents. These water quality parameters characterize levels of the most important electron donors, acceptors commonly found in groundwater, and probable products of the biodegradation process (e.g., Cl, CO_2).

Section References

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5.0 Conclusions

5.1 Appropriateness of Remedial Action Objectives

The EPA's primary responsibility at Superfund sites is to select remedial actions that are protective of human health and the environment. In addition, Section 121 of the CERCA establishes several other statutory requirements and preferences. These specify that when complete, the selected remedy for this site must comply with applicable or relevant and appropriate environmental standards established under Federal and State environmental laws unless a statutory waiver is justified. The selected remedy also must be cost-effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatments that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element.

As a part of this review all Remedial Action Objectives and associated ARARs were reviewed to determine if any changes had taken place at the site or within the regulatory environment which would change the cleanup goals.

All groundwater cleanup goals at the site are based on State of Florida groundwater criteria. Originally, these limits were codified as the drinking water criteria (FAC 62-550) and covered the compounds chromium, PCE, TCE, DCE and vinyl chloride while the acetone was governed as a Florida Groundwater Guidance concentration. In August, 1999 the State of Florida adopted new Groundwater Cleanup Target Levels as FAC 62-770. This rule incorporated compounds which had been regulated under various rules and imposed cleanup goals for compounds where no goal had existed prior. This revised rule was reviewed during the preparation of this document to determine if the cleanup goals, as stated in the ROD, had changed. A review of this rule has shown that all groundwater cleanup goals, as stated in the ROD, are still applicable and protective of human health and the environment.

The institutional control action level established for chromium in soil was originally developed as a risk based exposure concentration, and was based on the exposure expected to an industrial worker. The assumptions used to develop this risk based number have not changed and the property remains industrial. As such, the institutional control as it applies to chromium in the soil remains protective of human health and the environment.

5.2 Achievement of Remedial Action Objectives

As a part of the review process it is important to determine if RAOs are being met through the operation of the implemented remedy. As presented in Section 4.5 of this submittal, the concentrations of chromium in the surficial aquifer have declined throughout the operation of the implemented remedy. Notably, the concentrations of chromium detected in the last two sampling events (12/97 and 6/98) were below the established cleanup levels. Section 10.4 of the ROD states that "Groundwater will have to meet clean-up criteria, in monitoring well samples, for two successive semi-annual sampling rounds in order for site remediation to be complete." As such, the implemented remedy has achieved the remedial action goal as stated in the ROD for chromium in the surficial aquifer.

On a sitewide basis, the concentrations of VOCs in the surficial aquifer and in the Floridan Aquifer have exhibited an overall reduction of levels through the operation of the implemented remedy, but the cleanup goals have not yet been met. While there are wells that have shown an increase in contaminant levels reflecting movement of hot pockets within the plume, this does not reflect a deficiency in implemented remedy as overall concentrations continue to decline and will continue to decline with further operation of the remedy.

5.3 Demonstration That the Remedy is Effective and Functioning as Designed

The current implemented remedy consists of surficial groundwater recovery and treatment, plant production water (Floridan Aquifer) treatment and institutional controls. Additionally, continued sampling of the groundwater, surface water and sediments of Lake Miller and the completion of a fish tissue sampling event are continuing as required. While some O&M deficiencies associated with the groundwater recovery system had been noted in the past, procedures have been changed with the implementation of the O&M plan. This plan incorporates the continued implementation of all remedies specified for operable units 1 and 3, including the verification and monitoring

associated with the institutional controls. As such it has been determined that the remedy as a whole continues to be effective in the treatment as per the requirements of the ROD. The following is a review of each of the remedy components and an evaluation as to its effectiveness.

5.3.1 Surficial Aquifer Groundwater Recovery

The implemented remedy for the surficial groundwater at the site originally consisted of 9 groundwater extraction wells and an air stripper. Each extraction well has been constructed and screened to the top of the confining clay layer. Well screen and recovery pumps were designed so as to recover water from throughout the water column to the top of the clay. Three of the extraction wells (EW-7, EW-8 and EW-9) were installed adjacent to the an infiltration basin at the southeast corner of the property. These wells were shut down when usage of the basin was discontinued. The shut down of these wells was approved by the EPA Remedial Project Manager in a letter dated October 1, 1997. The remaining extraction wells (EW-1 through EW-6) were installed along the leading edge of the plume and were designed to intercept groundwater before it could enter the waters of Lake Miller.

The system was originally designed using fixed rate submersible pumps which would send a total of approximately 215 gallons per minute (gpm) to the air stripper. The pump rates were determined during modeling of the surficial aquifer. The air stripper was designed to treat anticipated contaminant loads at flow rates up to 325 gpm. Currently the air stripper is receiving less water than originally anticipated due to the elimination of three wells from the recovery system and operates between 130 and 160 gpm. The following are the anticipated pump rates for the recovery wells (as determined in the computer modeling) versus actual pump rates measured in September, 1999:

Well ID	Design gpm	Actual gpm
EW-1	15	22
EW-2	20	22.4
EW-3	15	12.6
EW-4	50	48
EW-5	30	21.8
EW-6	35	11
EW-7	20	0*
EW-8	20	0*
EW-9	20	0*

*Note: These wells were taken out of service.

As shown in this data, the northern portion of the recovery system is operating at or above the anticipated design pump rates while the two wells on the south side (EW-5 and EW-6) are operating slightly below the anticipated design pump rates. Three maps have been prepared which depict the potentiometric drawdown contours and the chemicals of concern (PCE, TCE and DCE) concentration isopleths. As shown in these figures (**Figures 14, 15, and 16** respectively) the remedy, as currently operating, is effective in capturing the leading edge of the main plume.

Recent sampling events have potentially detected a smaller plume which may be entering the site at the southeastern corner of the property. It is not known what the origin of this plume is at this time and a work plan is being developed to collect the necessary data to define the horizontal and vertical extent of this plume.

5.3.2 Air Stripper Treatment System

Water collected from the surficial aquifer is pumped to an air stripper on-site where it is treated prior to discharge to Lake Miller. This system was designed to treat 325 gpm of groundwater containing VOC's in excess of 2,000 ppb. The effectiveness of this system is tested twice a year when influent and effluent samples are collected and analyzed. The treated effluent is required to meet State of Florida Drinking Water Standards.

As described in **Section 5.3.1**, groundwater recovery rates are currently below the anticipated designed rate and the air stripper receives approximately between 130 and 160 gpm. Influent concentrations have risen over during recent sampling events with the removal of three extraction wells from the system which were thought to be pumping clean water. Currently (June, 1999) the system influent contains PCE (130 ppb), TCE (25 ppb) and DCE (20 ppb).

The effluent from the treatment system did not meet discharge criteria (for PCE) twice in 1994, once in 1995 and once again in 1996 as reported in the semi-annual monitoring reports. Under the previous O&M operations, the exceeding of the discharge criteria indicated that the media within the air stripper had become fouled resulting in reduced stripper efficiency. Each time this occurred the stripper would be backwashed and a subsequent sample collected. Each time the subsequent sample met the discharge criteria. To permanently resolve these occurrences, the air stripper media was replaced in 1997 and an acid recirculation system was added to clean the media. Under the O&M plan the media is cleaned on a monthly basis and even with the increased contaminant load, no breakthrough has been observed indicating the current revised O&M procedures on the air stripper have been effective.

5.3.3 Floridan Aquifer Groundwater Treatment

The Floridan Aquifer groundwater recovery and treatment system provides production water to the plant on a continuous basis. In times when the plant is shut-down or when water needs are reduced, water is still pumped and treated. Chemicals of concern (COCs) in the Floridan Aquifer (PCE, TCE and DCE) are monitored in the water supply well, a fire supply well and in a network of monitoring wells. Concentrations of these TCE and PCE have continued to decline overall in the two water supply wells but the occurance and concentration of breakdown compounds cis 1,2-DCE and vinyl chloride have slowly risen reflecting the natural biodegradation of the solvents.

It was noted during this review that one residential well (Lang) had historically shown low levels of COC's prior to the destruction of the well in 1996. An adjacent residential well at the Fire Station was also lost for monitoring purposes in 1995. This has left a data gap for the Floridan aquifer on the eastern side of the site. As a result of this review, a work plan is being developed to install Floridan aquifer monitoring wells to replace the residential wells along this side of the site.

The concentration of Acetone has risen above the cleanup criteria in the Upper Floridan wells FA-1 and FA-2 on two occasions. As a result of this review, a provision has been added to the O&M plan to complete confirmation sampling of these wells should the detected concentration of Acetone exceed the cleanup goal during the bi-annual sampling. If this elevated concentration of Acetone is again detected in the confirmation sampling, a meeting will be requested with the EPA and FDEP to determine if additional actions are necessary.

5.3.4 Institutional Controls

Institutional controls at the site are required by the RODs from OU-1 and OU-3. Only the institutional control requiring that the site be deed restricted has not been met at the time of this review. These controls and their implementation include:

- **Installation of 10 signboards around Lake Miller indicating "NO FISHING OR SWIMMING IN LAKE MILLER".**

  *Placement of these signs was reviewed by EPA personnel and are presented in **Figure 17**. These signs are checked on a biannual basis in accordance with the O&M plan.*

- **Installation of signs on all sides of the groundwater treatment facility warning that it is a hazardous waste treatment facility.**

  These signs were installed following construction of the system and are checked on a weekly basis in accordance with the O&M plan.

- **Notification of Mr. Mills, a property owner across Lake Miller from Sherwood, that Lake Miller should not be used for fishing or swimming purposes.**

  Mr. Mills was notified of the Lake Miller access restrictions following the signing of the OU-1 ROD and was reminded of this restriction during the Public Meeting for the OU-3 ROD. Mr. Mills is also verbally reminded of the restriction on a semi-annual basis in association with the sampling of monitor wells located on his property.

- **Maintenance of the fence to discourage trespassing on the Sherwood property and maintenance of the Sherwood regulations restricting employee access to Lake Miller.**

  The site has been fenced since manufacturing operations at the plant began. Sherwood personnel implemented the internal restrictions of employee access to the Lake at the time that the ROD was implemented. The plant has allowed the vegetation around the lake to grow wild restricting the casual to the lake. The condition of the fence is visually inspected for gaps during the weekly O&M of the groundwater recovery and treatment system by the O&M Contractor. On biannual basis, the O&M Contractor notifies the plant environmental coordinator of the continuing restriction of employee access to the lake.

- **Requirement that Sherwood notify FDEP and EPA of plans to excavate soils, demolish buildings, or remove pavement. Soils exposed as a result of these activities will be required to meet TCLP criteria or contain less than 520 mg/kg of chromium to remain on-site untreated.**

  This requirement was implemented with the acceptance of the ROD. The O&M Contractor observes the site for signs of excavation during the weekly O&M of the groundwater recovery and treatment system. The plant environmental coordinator also notifies the O&M Contractor of any planned excavations at the site. This notification includes the proposed location and depth of the excavation.

  Should an excavation at the site be noted by the O&M Contractor or should the O&M Contractor be notified by the plant environmental coordinator of a planned excavation, the O&M Contractor provides a letter to the plant manager stating the requirements of the ROD and seeking coordination of the plant environmental coordinator in the sampling of the excavated soils. A letter is also prepared for the EPA and the FDEP notifying them of the planned or discovered excavation as well as the plan for the collection of soil samples.

Upon identification of an on-site excavation or upon receipt of notification of a proposed excavation, soil samples are collected from those soils proposed to be excavated. If samples are to be collected prior to the initiation of an excavation, samples from the maximum proposed depth of the excavation are collected.

Each soil sample is analyzed for total chromium utilizing EPA method 7190 or EPA Method 6010. If the sample analysis indicates that the chromium concentration in the sample exceeds the limit established in the ROD (520 mg/kg) the laboratory is instructed to perform a TCLP test on the sample for chromium utilizing EPA Methods 1311/6010.

Upon receipt of the soil sampling analysis, the designated AHPC Superfund Project Coordinator notifies the EPA and the FDEP of the sample results. The letter is accompanied by a map showing the sample collection locations and copies of the laboratory analytical report

If any sample exceeds the ROD criteria for chromium (520 mg/kg) of fails to pass TCLP criteria the preventative or corrective action is taken. If the sample was collected from an existing excavation, the excavated soils are considered a waste and shipped off-site for disposal. If the sample was collected from the area of a proposed excavation, the plant environmental coordinator is notified and the location of the proposed excavation is moved if possible. If it is not possible to move the location of the excavation, the O&M Contractor will work with the plant environmental coordinator to limit the amount of soil which must be excavated. Excavated soil is further sampled and characterized and that which does not meet the criteria set forth in the ROD is be shipped off-site as a waste.

- **Requirement that the Sherwood Site remain an industrially zoned area or address elevated contaminant levels in all environmental media at the site such that the site does not pose a threat to human health and the environment as defined by EPA and FDEP**.

This requirement has not been met. AHPC personnel are developing the necessary restriction notifications which should be filed with the local property appraisers office by years end.

5.4 Contaminant Recovery

In an effort to help to determine the effectiveness of the remedial action, a calculation of contaminant mass removal for the surficial aquifer and the Floridan Aquifer was completed. This calculation was based on the influent concentrations measured at each of the air strippers during the bi-annual sampling. The influent concentrations and calculated mass recovery estimates are presented in **Table 9**. This estimate is based on the assumptions presented in **Table 9**.

5.5 Adequacy of O&M

As a part of the 5-year review the O&M of the implemented remedy has been evaluated to determine if it is adequate to maintain the effectiveness of the remedy. The original O&M plan was reviewed, as were system operational records and plant files.

Maintenance of the implemented remedy at the Sherwood site has been the responsibility of plant personnel under the original O&M Plan for the site. O&M activities focused on repairs to the system on an as-needed basis. Records for the activities were incorporated into facility management records with verbal reports being given to the manager of environment and safety as needed. Under this system, recovery rates declined as extraction wells became fouled from bacterial growth and iron deposits as the system aged.

To address declining recovery rates, plant personnel attempted repairs on the recovery wells and the air stripper as situations warranted. On at least two occasions, plant personnel pulled pumps from the recovery wells and attempted to clean the wells through the addition of chemical cleaners and through the brushing of the well casings. Upon receipt of analytical data indicating that chemicals of concern were being discharged from the air stripper, plant personnel would backwash the media. Repairs of this nature would remedy the situation.

In 1997, Sherwood personnel contracted with an outside contractor to refurbish the recovery wells and the air stripper. During this effort, well pumps were pulled, inspected and cleaned, the well screens and sand packs were chemically treated and the wells were redeveloped using pump and surge methods, All air stripper media was removed, the stripper tower was scraped and cleaned, the media was replaced with new media and an acid recirculation system was added to backwash the media.

In conjunction with the development of the 5-year review report a new O&M plan has been developed and new procedures were put into operation beginning on May 15, 1998. The activities associated with the O&M plan, which address the requirements for both OU-1 and OU-3 activities are performed by an outside contractor. The focus of the new O&M plan is in preventative maintenance to keep the system operating at peak performance. System controls have been updated as have flow meters, flow sensors and the programmable logic controller (PLC). Problems with any of the sensors; will allow the PLC to shut down any individual well pump or it can shut down the entire system in the event of a system emergency (i.e. stripper blower shutdown, low or high stripper water levels, system electrical disturbance, etc.). All alarm systems have been attached to a telemetry system which allows the system to alert the O&M Contractor in the event of a system shutdown. The O&M Contractor is equipped to respond to system emergencies within hours should the situation warrant such response.

The following text summarizes the O&M plan.

5.5.1 System Inspections

Regular inspections of the site and the facilities are an integral part of the revised O&M plan and are accomplished on a weekly basis. Tasks that fall under the inspection include the following:

- observing site surface conditions including well vault maintenance, presence of seeps or leaks, or erosion at the well vaults or along piping runs
- noting the condition of fencing and other access controls
- noting the presence of or potential for soil excavations or other soil intrusive actions
- verifying integrity of wells and wellheads

- recording operation data including pump rates, water elevations and system flow rates
- inspecting of the treatment plant components and appurtenances
- verification that the air stripper for the Floridan aquifer is operating and record the flow

5.5.2 Routine Maintenance

Routine maintenance activities are necessary to ensure that the remedy functions properly and as it was initially designed. These tasks are conducted on monthly and quarterly basis to prevent major remedy adjustments or repair in the long run. Some of these routine maintenance activities are as follows:

- acid wash air stripper media
- test and clean all automatic controls
- dismantle and clean/repair all recovery well pumps
- test and clean all flow sensors and meters
- verifying adherence to institutional controls
- repairing signs and warnings

5.5.3 Sampling and Analysis

Sampling and analysis is required on a semi-annual basis for OU-1 and OU-3 to monitor remedy performance and site status. Sampling protocol and procedures for both operable units have been incorporated into the O&M plan.

Samples are collected from the following sources:

OU-1

- residential potable wells
- surficial aquifer groundwater monitoring wells
- Floridan aquifer monitoring wells
- plant water and fire supply wells
- air stripper influent and effluent

OU-3

A one time sampling and analysis of fish tissue from Lake Miller and adjacent lakes is required by the OU-3 ROD. A work plan for this effort is being developed and it is anticipated that the samples will be collected during the 1st quarter of 2000.

Additional OU-3 bi-annual sampling includes:

- Lake Miller sediments
- Lake Miller surface water

5.5.4 Reporting

Reporting is necessary to demonstrate to EPA that proper O&M is occurring at the site. Reporting is done by AHPC to the EPA and FDEP. Reports include:

- Semi-annual sampling reports for OU-1 and OU-3 including potentiometric data and plume isocontour maps
- Annual O&M reports including system failure and repair information, system modifications, contaminant mass recovery estimates and pumping records for the surficial aquifer groundwater recovery system and the Floridan aquifer.
- Soil excavation reports (as required)
- Contact/complaints received from the community.

5.5.5 Conclusion

This review documented that the O&M of the implemented remedy had been sufficient to keep the system operating, but that some individual O&M activities could not be fully documented. It was determined that the operation of the system could be enhanced by preventative maintenance activities on a scheduled basis. An O&M plan covering all ROD requirements for OU-1 and OU-3 has been implemented. The revised O&M plan relies on preventative maintenance to prevent declines in system recovery or treatment rates. The changeover to the revised O&M plan was accomplished on May 15, 1998.

5.6 Early Indicators of Potential Remedy Failure

Indicators of remedy failure at the site will be evident either with the failure of capture of the surficial plume or the inability of the identified O&M activities to keep the implemented remedy operational.

Currently the surficial plume is captured along the downgradient front of the plume through 6 groundwater extraction wells. Effectiveness of this capture is monitored through the preparation of potentiometric maps which depict the radius of influence of the extraction wells and monitoring of the COCs within the surficial aquifer groundwater.

It has been noted that there are deficiencies in the monitoring of the Floridan Aquifer with the loss of some residential monitoring points and that a small surficial aquifer plume is entering the site from an upgradient location. A work plan is being developed in conjunction with this review to address the enhancement of the monitoring network.

The O&M plan has been revised in association with this review. Revisions focus primarily on instituting a program of preventative maintenance to prevent problems from occurring. An overall rehabilitation of the system including cleaning and redevelopment of the recovery wells, cleaning of the recovery pumps and the cleaning and repacking of the air stripper has restored these system components to their design standards.

6.0 Deficiencies

While the primary purpose of the 5-year review is to determine whether the remedy remains protective of human health and the environment (**Section 5** of this report), the EPA Guidance on the 5-year review (Draft - March, 1998) also requires that the review note all deficiencies, in particular, those that currently or in the future, may prevent the remedy from being protective or from achieving the remedial action objectives (EPA Guidance Manual Section V-B). Deficiencies may result from changes to the site characteristics, changes in the nature and extent of the Chemicals of Concern (COCs), failure of the implemented remedy to operate as designed or failure of the remedy to achieve design specifications.

Deficiencies in the selected remedy were noted during the review process. The deficiencies and their identified causes as determined during the review process are summarized in this section. Recommendations and procedures implemented to alleviate these deficiencies are presented in **Section 7** of this report.

6.1 O&M Record Keeping and Reporting

In reviewing the O&M for the implemented remedy, it was noted that there was no central administration of O&M activities or the record keeping associated with those activities at the plant. All O&M manuals, contracts and analytical data were filed in the office of plant environmental coordinator at the Deland site who was responsible for the local administration of the NPL site. At the start of this review, the maintenance of the remedy was conducted by plant maintenance personnel, who were located in another building at the site. All notes or observation files on the operation of the system were contained within the office of the plant maintenance personnel.

With the implementation of the revised O&M procedures (May 15, 1998), all O&M activities and the management of data, became the responsibility of the an outside consulting firm, currently Qore, Inc. (O&M Contractor).

6.2 O&M Activities

At the start of this review process it was noted that there was a separation of responsibilities for the administration of the selected remedy and the O&M of the remedy. As stated in Section 6.1, the O&M manual was located in the office of plant environmental coordinator while the maintenance of the system was conducted by plant maintenance personnel. The O&M manual for the implemented remedy listed tasks which were to be performed in the event the system failed to meet established operational criteria. These tasks included cleaning recovery wells, servicing groundwater recovery pumps and cleaning or replacing the media within the air stripper. The O&M manual did not establish a program of preventative maintenance to keep failures from occurring and therefore, no preventative maintenance program was ever established. Rehabilitation efforts were therefore performed on a reactionary basis when a notable decline or failure of the operation of the system had taken place such as the shutdown of the recovery system or the exceedence system discharge criteria (6/94, 12/94, 12/95 and 12/96) due to fouling within the air stripper.

With the implementation of the revised O&M procedures on May 15, 1998 (O&M Plan), a preventative maintenance program has been implemented and there have been no unplanned system shutdowns or discharge criteria exceedences. All preventative maintenance activities are performed by the O&M Contractor.

6.3 Institutional Controls

Section 10.6 item (5) of the Record of Decision states a requirement that the FDEP and the EPA be notified should any soil disturbance at the plant take place and that samples be collected from any excavated soils. This review determined that no formal procedure covering regulatory notification or subsequent sampling actions was in place at the time of the review. The preparation of the O&M plan has included a procedure for regulatory notification and sampling in the event of soil excavations. This procedure was implemented in May, 1998.

The Record of Decision for OU-1 states a requirement that the property remain industrially zoned and the ROD for OU-3 further states that the property be deeded industrial. This review determined that this criteria had not yet been met. At the time of this submittal, the legal department of AHPC was in the process of determining the methodology for compliance with this criteria.

6.4 Capture Zone

As a part of this review, surficial aquifer groundwater concentration isopleths were overlaid onto maps depicting groundwater recovery system drawdown contours to determine if the implemented remedy was achieving capture of the plume within the surficial aquifer. It was noted that the capture zone produced by the extraction well operation was not extending as far south as necessary to efficiently capture the entire leading edge of the plume in the surficial aquifer. Upon review of groundwater recovery well operational data it was noted that the two southernmost recovery wells were not operating at full capacities and that drawdown was therefore less than optimal. Following identification of this problem, the wells were serviced by the O&M Contractor resulting in an increase in the groundwater extraction rates. New system drawdown/contaminant isopleth maps (**Figures 14-16**) were then prepared, demonstrating that the system is now achieving capture of the plume in the surficial aquifer.

6.5 Surficial Aquifer Plume Delineation

During the remedial investigation (1990 - 1992), a network of groundwater monitoring wells was installed in the surficial aquifer to delineate the extent of contamination within the surficial aquifer. All surficial aquifer monitoring wells were installed on the Sherwood property. An examination of the PCE concentration isopleth maps during this review indicated that the PCE contaminant plume within the surficial aquifer may extend beyond the boundaries of the Sherwood property in the upgradient direction. The extent of the contaminant plume in the surficial aquifer along Kepler Road, as shown in wells MW-108 and MW-109 did not appear to be completely delineated. Chemicals of concern (PCE and TCE) have also been detected in one upgradient well (MW-114) and the three extraction wells (EW-7, EW-8 and EW-8) at the southeastern corner of the property. PCE and TCE have been detected in the last 5 sampling events (6/97 through 6/99) indicating that a potential contaminant plume may be entering the site from an off-site location. A review of the October 1999 potentiometric map (**Figure 10**) shows that water approaches this well from across Kepler Road and there are no monitoring wells upgradient of this point to delineate the extent of the plume. It is not known if the chemicals detected in this well (MW-114) in the groundwater originated at Sherwood property or if an unknown off site source is migrating onto the Sherwood property.

As result of this review process, a work plan is being developed to collect additional data to delineate the surficial contaminant plume.

6.6 Floridan Aquifer Plume Delineation

During the remedial investigation, groundwater samples were collected from Floridan Aquifer residential wells and Floridan Aquifer monitoring wells were installed to delineate the extent of contamination in the Floridan aquifer. Sampling of these wells continued as a part of the bi-annual sampling required by the ROD for OU-1. During the period of time that the remedy has been in operation, the City of Deland has extended the potable water supply to the residences adjacent to the site and two of the existing residential wells (Fire Station and Lang) are no longer operational and therefore not available for sample collection. This review notes that with the loss of these two residential monitoring points there is no longer adequate monitoring of the Floridan aquifer along the eastern side of the plant.

As result of this review process, a work plan is being developed to install additional Floridan Aquifer monitoring wells to the east of the plant.

6.7 Floridan Aquifer Acetone Monitoring

It was noted during this review that acetone concentrations had risen above the cleanup criteria during the June, 1998 sampling event in Upper Floridan monitoring wells FA-1 and FA-2. The detected concentrations had dropped below cleanup criteria in well FA-1 when the wells were sampled in December, 1998, but remained above cleanup criteria in well FA-2. The concentrations in both wells were below the cleanup criteria when each well was sampled during the June, 1999 biannual sampling event. This review notes that there was no process in place for addressing the rise in acetone concentrations, nor was there an action plan to address increases in acetone concentrations in the Upper Floridan aquifer.

As result of this review, a process has been implemented to conduct a confirmation sampling of a well in the event that the acetone concentration detected in that well exceeds the cleanup criteria. Should the resampling confirm the elevated concentration of acetone, a meeting will be scheduled with the EPA and the FDEP to identify what additional actions may be necessary.

7.0 Recommendations

As deficiencies were identified during the 5-year review process, recommendations were developed to address the deficiencies. This section presents recommendations to address items discussed in **Section 6** of this report.

7.1 O&M Record Keeping and Reporting

As a provision of the sale of the Sherwood plant, AHPC contractually agreed to continue site cleanup and assumed all O&M activities. The O&M Contractor was retained to assist in the development of the O&M plan which was implemented on May 15, 1998, and to provide O&M pursuant to the revised plan. Details of the O&M plan, including procedures for record keeping and reporting have been presented in this 5-Year Review report and the O&M plan will be submitted to the EPA and FDEP in December, 1999. Under this plan, all O&M records will be computerized and reports will be produced on an annual basis. Computerization of the O&M records allows for accurate tracking of system operational parameters between scheduled maintenance. Additional O&M activities can now quickly be implemented should a situation warrant. The first draft of the O&M plan is scheduled for submittal to EPA on December 15, 1999.

7.2 O&M Activities

Under the O&M plan, all system components receive preventative maintenance on a scheduled basis rather than on an as-needed basis. Computerization of the O&M records allows for accurate tracking of operation parameters between scheduled maintenance. Additional O&M activities can now quickly be implemented should a situation warrant. Implementation of these revised procedures has re-established the capture zone of the operating system and no discharge criteria exceedences have been noted since implementation of this plan in May, 1998.

7.3 Institutional Controls

Under the O&M plan, the system and surrounding properties are inspected on a weekly basis and routine maintenance activities associated with the selected remedy are completed monthly and quarterly. Sampling of the groundwater and Lake Miller is accomplished on a bi-annual basis. As a part of these inspections and sampling events, the O&M Contractor is regularly onsite and the O&M plan has incorporated the inspection of the various institutional controls into these visits.

A program has been implemented where the plant environmental coordinator notifies the O&M Contractor when excavations are planned and sample collection is then coordinated. The site is also inspected weekly and areas where excavation or other soil invasive actions have taken place, or may be planned, can be identified. The required regulatory notifications and the collection of the required soil samples can then be accomplished. During the routine visits, warning signs on the treatment system are inspected and the operation of the Floridan Aquifer air stripper is verified. Also observed at this time is the condition of the site fencing.

The O&M Contractor is responsible for the bi-annual sampling of Lake Miller and the groundwater monitoring wells. During the biannual sampling, the O&M Contractor notifies the plant environmental coordinator of the continuing restriction of employee access to the lake. Mr. Mills is also verbally reminded of the restriction on a semi-annual basis in association with the sampling of monitor wells located on his property. Signs posted on Lake Miller are also inspected during the sampling of the Lake.

This review noted that the industrial deed restriction for the property had not yet been filed. At the time of this submittal, the legal department of AHPC was in the process of determining the methodology for compliance with this criteria.

7.4 Capture Zone

At the start of the review process it was identified that two wells on the southern end of the groundwater recovery system were not at all times producing efficient drawdown. These wells were repaired by the O&M Contractor and the situation was remedied in that the entire leading edge of the contaminant plume is now within the capture zone of the system. Preventative maintenance procedures implemented under the O&M plan have been demonstrated to be sufficient in reestablishing the capture zone and to prevent the reoccurrence of this situation.

7.5 Surficial Aquifer Plume Delineation

It has been noted during this review that the extent of the contamination in the surficial aquifer has not been identified in the upgradient area or at the southeast corner of the plant. A work plan is being developed to address this situation. This work plan will include sampling of the surficial

groundwater through the use of direct push technology and the installation of additional groundwater monitoring wells.

7.6 Floridan Aquifer Plume Delineation

It has been noted during this review that the monitoring of the horizontal extent of the groundwater quality in the Floridan aquifer can no longer be adequately accomplished due to the unavailability of two residential wells previously used for monitoring. Low levels of solvents had been identified in one of these wells. A work plan is being developed to address this situation. This work plan will include the installation of at least two additional groundwater monitoring wells into the Floridan aquifer which will allow for continued monitoring of the zone on a biannual basis.

7.7 Floridan Aquifer Acetone Monitoring

It was noted during this review that the concentrations of acetone have risen above the cleanup criteria on two occasions in the Upper Floridan monitoring wells FA-1 and FA-2. This review notes that there is no mechanism for confirming the rise in acetone concentrations nor is there an action plan to address increases in acetone concentrations in the Upper Floridan aquifer. To address this situation, a provision has been added to the O&M plan to allow for confirmation sampling of these wells following the identification of a sample result which exceeds the cleanup goal. Should the elevated concentration be again detected, a meeting with the EPA and the FDEP will be requested to identify what other actions may be necessary.

8.0 Protectiveness Statement

The selected remedy for the Sherwood Medical Industries site, Operable Units 1 and 3 has undergone an initial 5-year review. No deficiencies were noted which detract from the ability of the selected remedy to protect human health and the environment. While the remedial action is still underway, the remedy remains protective of human health and the environment through extraction and treatment of the affected surficial aquifer. Treatment water from of the surficial aquifer continues to effectively reduce risk from exposure to the surficial aquifer as well as prevent further migration of the groundwater plume to the Floridan aquifer and Lake Miller. Treatment of water from the Floridan aquifer reduces the risk of migration of contaminants which may percolate from the surficial aquifer. The combined institutional controls along with the monitoring requirements will serve to ensure protection of human health and the environment.

Upon completion of the remedial action, the remedy is expected to meet the requirements of the ROD to ensure protectiveness.

_____ _____

Mr. Richard D. Green Date
Director Waste Management Division
U.S. Environmental Protection Agency
Region IV

9.0 Next Review

As the continued implementation of the selected remedy results in hazardous substances remaining on-site above health based levels, a review will be conducted 5-years after commencement of this review to ensure that this remedy continues to provide protection of human health and the environment.

TABLES

Table 1. Chronology of NPL Listing and Interim Action (OU2)

Event	Date
Chromium waste sludge removed from surface impoundments and disposed of off-site.	1980-1982
The Florida Department of Environmental Regulation (FDER) applied the Environmental Protection Agency (EPA) Hazard Ranking System to the Sherwood Medical Industries site and placed the site on the National Priorities List (NPL).	June 1982
Site placed on the NPL.	September 8, 1983
Sherwood installed an industrial wastewater treatment facility to treat chromium in the process wastewater to levels regulated by Florida Drinking Water Quality Criteria.	July 1983
EPA determined that a modified Remedial Investigation (RI) to assess the adequacy of the interim remedial actions taken by Sherwood was necessary.	January 1985
Onsite groundwater contamination of the Floridan aquifer was confirmed by additional samples.	October 1986
Air stripper added to plant water supply well to remove VOC's from production water supply.	1986
EPA and Sherwood entered into an Administrative Consent Order (ACO) in which the facility (Sherwood) agreed to conduct the RI/FS.	September 1987
Wastewater treatment plant connected to City of DeLand sewer system. Plant potable water supply connected to City of DeLand water system.	1997

Table 2. Chronology of Remedy Development and Implementation.

Event	Date
Field activities initiated to complete the Remedial Investigation.	February 1990
EPA issued an Interim Record of Decision (IROD) on March 27, 1991 for the IRM-2 program at the site.	March 1991
Sherwood agrees to study Lake Miller surface water to determine if it is suitable to receive treatment system discharge.	June 1991
Lake Miller field investigations	July/November 1991
Sherwood and EPA entered into a Consent Agreement in an effort to commence remediation of the surficial aquifer. The Consent agreement was for the installation of the IRM-2 groundwater extraction and treatment system.	August 1991
Lake Miller Water Quality Report issued. Data incorporated into site Remedial Investigation Report	November, 1991
Final Design Package - IRM-2 submitted to EPA and FDER included the plans, specifications, design analysis and calculations, construction schedule and construction cost estimate.	February 1992
Operation and Maintenance Plan submitted to EPA and FDER included information to ensure reliable system operation and maintenance of the groundwater extraction and treatment system.	February 1992
IRM-2 system installation.	July 1992
Final inspection and startup of IRM-2 system.	July 29, 1992
Final RI/FS submitted to EPA.	July 1992
ROD on final remedy for surficial aquifer at the site signed by EPA.	October 1992
Final IRM-2 remedial action report complete.	January 1993

Table 2. Chronology of Remedy Development and Implementation.

(Continued)

After further Lake Miller Studies completed, Sherwood issues draft report "Evaluation of Effects of Chromium in Sediments, Lake Miller"	December 1993
EPA and Sherwood conduct independent evaluations of Lake Miller.	June/July 1994
Results of EPA sampling efforts reported	July 1994
Results of Sherwood sampling efforts reported	May 1995
EPA Proposed Plan Fact Sheet (OU3) issued	June 1997
Public meeting on ROD for OU-3	July 1997
Final ROD for OU-3 signed by EPA	September, 1997
Draft 5-Year Review of Sherwood Site submitted to EPA	October 1998
Final 5-Year Review Report issued	December 1999
Sitewide O&M Plan issued	December 1999

Table 3. Site Documents Reviewed

1.	Hydrologic Evaluation of Effluent Disposal at Sherwood Medical Company, David N. Gomberg, Ph.D., Water Resources Consultant, May 10, 1983.
2.	RI/FS Work Plan for Sherwood Medical Facility, Roy F. Weston, Inc., December 1989.
3.	Final Interim Remedial Measures Report for Sherwood Medical, Roy F. Weston, Inc., November 1989.
4.	Remedial Design Work Plan/Preliminary Design for Surficial Aquifer Groundwater Remediation for Sherwood Medical Company, Roy F. Weston, Inc., April 1991.
5.	Interim Remedial Measures 2 Draft Report for Sherwood Medical, Roy F. Weston, Inc., May 1991.
6.	Final Report on the Site Remedial Investigation for Sherwood Medical Company, Roy F. Weston, Inc., July, 1992
7.	Record of Decision Operable Unit 2 Declaration, Patrick Tobin, Deputy Regional Administrator, Region IV, United States Environmental Protection Agency, October 8, 1992.
8.	IRM-2 Remedial Action Report Sherwood Medical Company, Roy F. Weston, Inc., January 1993.
9.	Final Report Operable Unit 2 Performance Standard Verification Field Sampling & Analysis Plan for Sherwood Medical Company, O'Brien & Gere Engineers, Inc., January 1994.
10.	Draft Operation and Maintenance Manual Surficial Aquifer Ground Water Remediation IRM-2 Program for Sherwood Medical Company, O'Brien & Gere Engineers, Inc., August 1995.
11.	Operable Unit 1 Site Status Review Sherwood Davis & Geck, December 1997.
12.	NPL Sites Record of Decision 5-Year Review Guidance (Second Interim Draft), United States Environmental Protection Agency, Region IV, March 16, 1998.
13.	Groundwater Sampling Report, Sherwood Medical Industries, Inc., Environmental Science & Engineering, Inc, July, 1994.
14.	Groundwater Sampling Report, Sherwood Medical Industries, Inc., Environmental Science & Engineering, Inc, January, 1995.

Table 3. Site Documents Reviewed

(continued)

15.	Groundwater Sampling Report, Sherwood Medical Industries, Inc., Environmental Science & Engineering, Inc, July, 1995
16.	Groundwater Sampling Report, Sherwood Medical Industries, Inc., Environmental Science & Engineering, Inc, January, 1996.
17.	Groundwater Sampling Report, Sherwood Medical Industries, Inc., Environmental Science & Engineering, Inc, July, 1996.
18.	Groundwater Sampling Report, Sherwood Medical Industries, Inc., Environmental Science & Engineering, Inc, January, 1997.
19.	Groundwater Sampling Report, Sherwood Medical Industries, Inc., Environmental Science & Engineering, Inc, July, 1997.
20.	Groundwater Sampling Report, Sherwood Medical Industries, Inc., Environmental Science & Engineering, Inc, January, 1998.
21.	Groundwater Sampling Report, Sherwood Medical Industries, Inc. NPL Site Operable Unit 1, QST Environmental, July, 1998.
22.	Groundwater Sampling Report, Sherwood Medical Industries, Inc. NPL Site Operable Unit 1, QST Environmental, January, 1999.
23.	Groundwater Sampling Report, Sherwood Medical Industries, Inc. NPL Site Operable Unit 1, Environmental Science & Engineering, Inc., July, 1999.

Table 4. Subsurface Investigation Soil Boring Summary

Boring ID	Date Drilled	Land Elev (ft-msl)	Boring Depth (ft)	Clay Depth (ft)	Clay Elev (ft-msl)	Clay Interval (ft)	Rock Depth (ft)	Rock Elev (ft-msl)
SB-1	2/90	74.4	8	NE	NE	NE	NE	NE
SB-2	3/90	72.3	6	NE	NE	NE	NE	NE
SB-3	2/90	68.7	2	NE	NE	NE	NE	NE
SB-4	3/90	69.8	48	47	22.8	NP	NE	NE
SB-5	3/90	71.8	6	NE	NE	NE	NE	NE
SB-6	2/90	68.6	2	NE	NE	NE	NE	NE
SB-7	2/90	69.5	2	NE	NE	NE	NE	NE
SB-8	3/90	71.8	46	44.5	27.3	NP	NE	NE
SB-9	2/90	68.3	2	NE	NE	NE	NE	NE
SB-10	2/90	69.5	2	NE	NE	NE	NE	NE
SB-11	2/90	72.3	6	NE	NE	NE	NE	NE
SB-12	2/90	73.0	6	NE	NE	NE	NE	NE
SB-13	2/90	71.8	6	NE	NE	NE	NE	NE
SB-14	2/90	71.6	6	NE	NE	NE	NE	NE
SB-15	2/90	69.0	44	42.5	26.5	NP	NE	NE
SB-16	2/90	69.8	4	NE	NE	NE	NE	NE
SB-17	2/90	70.0	4	NE	NE	NE	NE	NE
SB-18	2/90	69.2	2	NE	NE	NE	NE	NE
SB-19	2/90	65.4	4	NE	NE	NE	NE	NE
SB-20	2/90	64.9	4	NE	NE	NE	NE	NE
SB-21	2/90	65.5	48	44	21.5	NP	NE	NE
SB-22	2/90	63.5	4	NE	NE	NE	NE	NE
SB-23	2/90	61.6	4	NE	NE	NE	NE	NE

Note: All elevations are mean sea level
All depths are measured from land surface

NE - Not Encountered
NP - Not Penetrated
SB - Soil Boring
N1 - Not Installed
NM - Not Measured
Rock Elevation - 57/79 - First number indicates limestone, second number indicates dolomite

Table 4. Subsurface Investigation Soil Boring Summary

(continued)

Boring ID	Date Drilled	Land Elev (ft-msl)	Boring Depth (ft)	Clay Depth (ft)	Clay Elev (ft-msl)	Clay Interval (ft)	Rock Depth (ft)	Rock Elev (ft-msl)
SB-24	2/90	60.3	4	NE	NE	NE	NE	NE
SB-25	2/90	NM	62	49.5	NE	NP	NE	NE
SB-26	2/90	59.4	4	NE	NE	NE	NE	NE
SB-27	2/90	59.6	4	NE	NE	NE	NE	NE
SB-28	2/90	61.8	6	NE	NE	NE	NE	NE
SB-29	2/90	59.0	4	NE	NE	NE	NE	NE
SB-30	3/90	59.7	38	NE	NE	NE	NE	NE
SB-31	2/90	62.0	6	NE	NE	NE	NE	NE
SB-32	2/90	64.0	8	NE	NE	NE	NE	NE
SB-33	2/90	64.4	8	NE	NE	NE	NE	NE
SB-34	3/90	63.8	44	38.5	25.3	NP	NE	NE
SB-35	2/90	62.7	6	NE	NE	NE	NE	NE
SB-36	3/90	65.1	8	NE	NE	NE	NE	NE
SB-37	3/90	66.6	8	NE	NE	NE	NE	NE
SB-38	2/90	66.8	8	NE	NE	NE	NE	NE
SB-39	2/90	67.4	8	NE	NE	NE	NE	NE
SB-40	3/90	68.5	8	NE	NE	NE	NE	NE
SB-41	3/90	69.6	54	42	27.6	42-52	NE	NE
SB-42	3/90	70.0	10	NE	NE	NE	NE	NE

Note: All elevations are mean sea level
All depths are measured from land surface

NE - Not Encountered
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SB - Soil Boring
N1 - Not Installed
NM - Not Measured
Rock Elevation - 57/79 - First number indicates limestone, second number indicates dolomite Sherwood Medical Industries NPL Site

Table 4. Subsurface Investigation Soil Boring Summary

(continued)

Boring ID	Date Drilled	Land Elev (ft-msl)	Boring Depth (ft)	Clay Depth (ft)	Clay Elev (ft-msl)	Clay Interval (ft)	Rock Depth (ft)	Rock Elev (ft-msl)
SB-43	3/90	70.7	10	NE	NE	NE	NE	NE
SB-44	3/90	70.9	10	NE	NE	NE	NE	NE
SB-45	3/90	57.9	2	NE	NE	NE	NE	NE
CS-1	1988	75.5	101	44	31.5	5	101	-25.5
CS-4	1988	74.8	50	45	20	NP	NE	NE
CS-7	1988	68.8	93	43	24	8	93	-17.5
CS-18	1988	66	50	41	25	8	NE	NE

Note: All elevations are mean sea level
All depths are measured from land surface

NE - Not Encountered
NI - Not Installed
NP - Not Penetrated
NM - Not Measured
SS - Soil Boring
Rock Elevation - 57/79 - First number indicates limestone, second number indicates dolomite

Table 5. Groundwater Monitoring Wells

Well ID	Date Drilled	Land Elev (msl)	Boring Depth (ft)	Clay Depth (ft)	Clay Elev (msl)	Clay Interval (ft)	Rock Depth (ft)	Rock Elev (msl)	Well Depth (ft)	Screen Interval (ft)
MW-101	9/88	63.1	39	37	26.1	NP	NE	NE	36	26-36
MW-102	9/88	66.7	39	35	31.7	NP	NE	NE	39	29-39
MW-103	9/88	63.7	40	39	24.7	NP	NE	NE	38	28-38
MW-104	9/88	61.1	51.5	49	12.1	NP	NE	NE	49	39-49
MW-105	9/88	59.8	56	55.5	4.3	NP	NE	NE	54.5	44.5-55.5
MW-106	10/88	62.0	51	45	15	NP	NE	NE	46	36-46
MW-107	10/88	67.3	47	45	22.3	NP	NE	NE	44	34-44
MW-108	10/88	72.1	49	45	27.1	NP	NE	NE	45	35-45
MW-109	9/88	75.2	52	52	23.2	NP	NE	NE	50	40-50
MW-110	10/88	71.8	45	40	31.8	NP	NE	NE	40	30-40
MW-111	10/88	64.5	72	63	9	NP	NE	NE	60	50-60
MW-112	9/88	58.7	36	34	24.7	NP	NE	NE	34	24-34
MW-113	3/90	73.8	49	47	26.8	NP	NE	NE	45	35-35
MW-114	1/91	69.03	43	43	26.03	NP	NE	NE	40.5	30-40

Note: All elevations are mean sea level
All depths are measured from land surface

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NI - Not Installed
NM - Not Measured
Rock Elevation - 57/79 - First number indicates limestone, second number indicates dolomite

Table 5. Groundwater Monitoring Wells

(continued)

Well ID	Date Drilled	Land Elev (msl)	Boring Depth (ft)	Clay Depth (ft)	Clay Elev (msl)	Clay Interval (ft)	Rock Depth (ft)	Rock Elev (msl)	Well Depth (ft)	Screen Interval (ft)
MW-201	2/90	60.4	257	49	11.4	12	97/ 172	-37 -112	232	192-232
MW-202	2/90	63	580	32	31	5	91/ 166	-28 -103	538	498-538
MW-203	3/90	58.98	560	55	4	4	109/ 177	-50 -118	539	499-539
MW-204	5/90	62.43	239	30	32.5	17	85/ 176	-22.5 - 113.5	237	197-237
MW-205	7/90	62.32	540	42	20	13	87.5/ 171	-25 -109	536	496-536
SMFA-1	1/91	70.78	UNK	UNK	UNK	UNK	UNK	UNK	170	140-170
SMFA-2	6/90	69.5	UNK	UNK	UNK	UNK	UNK	UNK	228	188-228
SMFA-3	6/90	68.08	UNK	UNK	UNK	UNK	UNK	UNK	240	200-240

Note: All elevations are mean sea level
All depths are measured from land surface

NE - Not Encountered
NP - Not Penetrated
SB - Soil Boring
NI - Not Installed
NM - Not Measured
Rock Elevation - 57/79 - First number indicates limestone, second number indicates dolomite

Table 6. Groundwater Extraction Wells

Boring ID	Date Drilled	Land Elev (msl)	Boring Depth (ft)	Clay Depth (ft)	Clay Elev (msl)	Well Depth (ft)	Screen Interval (ft)
EW-1	2/91	62	39	37	25	38.5	8.5-38.5
EW-2	1/91	60	42	40	20	40	20-40
EW-3	2/91	62	43	40	22	39.5	9.5-39.5
EW-4	2/91	61	61	60	1	59	29-59
EW-5	2/91	57	52	48	9	48	28-48
EW-6	3/91	57	47	47?	10	45	25-45
EW-7	3/91	68	46	44	24	45	25-45
EW-8	4/91	68.5	46	45.5	23	45	15-45
EW-9	4/91	68	46.5	46	22	45.5	15.5-45.5

Note: All elevations mean sea level
All depths are measured from land surface

NE - Not Encountered
NP - Not Penetrated
SB - Soil Boring
ft - Feet
NI - Not Installed
NM - Not Measured
LS - Limestone
MSL - Mean Sea Level

Table 7.
WATER ELEVATIONS - JUNE 1995 TO PRESENT
SHERWOOD MEDICAL INDUSTRIES NPL SITE
DELAND FLORIDA

Well ID	TOC Elevation	June 1995	Dec 1995	June 1996	Dec 1996	June 1997	Dec 1997	June 5 1998	June 11 1998	Nov 30 1998	June 7 1999
MW-101	66.93	53.71	54.18	54.09	54.50	53.55	54.84	54.30	54.62	54.71	52.70
MW-102	71.08	55.03	55.64	55.87	56.11	54.39	56.19	56.04	56.66	56.03	53.74
MW-103	65.28	53.18	54.08	54.17	54.44	51.44	52.63	51.80	54.53	54.25	52.38
MW-104	65.35	51.71	52.40	52.77	53.08	50.82	51.74	51.74	54.31	53.39	50.23
MW-105	63.18	54.05	54.75	54.84	55.47	53.64	52.75	54.54	55.98	55.18	52.81
MW-106	62.79	54.98	55.50	56.01	56.30	52.91	54.92	53.62	54.67	54.88	52.95
MW-107	70.76	63.35	63.27	63.65	63.02	58.32	61.09	60.43	60.05	61.10	58.72
MW-108	74.62	64.27	65.84	65.64	66.26	62.40	65.51	64.99	64.80	64.72	61.85
MW-109	77.68	65.86	67.71	67.50	68.08	65.03	67.86	67.26	67.05	66.82	63.96
MW-110	75	60.05	61.44	61.45	61.81	59.40	61.60	61.09	61.03	61.00	58.84
MW-111	66.77	61.41	61.28	61.55	60.90	55.48	59.00	57.80	57.67	58.57	56.35
MW-112	62.49	53.16	53.99	53.97	54.87	53.16	54.69	53.13	53.49	53.64	52.14
MW-113	75.83	66.71	68.47	68.33	69.05	66.16	68.88	68.23	67.98	67.70	64.81
MW-114	71.03	61.93	61.37	62.08	64.77	56.38	62.51	61.50	61.31	61.79	59.24
MW-201	62.48	36.73	39.51	38.37	39.77	37.84	39.72	ND	36.55	39.04	36.00
MW-202	65.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-203	58.99	31.52	34.88	32.83	34.22	32.69	33.45	ND	31.74	34.04	29.98
MW-204	62.43	34.83	39.99	35.92	37.20	35.79	37.54	ND	34.52	36.94	33.31
MW-205	62.32	32.79	35.10	33.84	35.12	33.30	34.95	ND	32.68	34.39	ND
FA-1	71.06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FA-2	71.11	34.09	35.97	35.01	36.30	34.89	36.56	ND	33.78	36.04	32.42
FA-3	68.08	34.69	36.26	35.51	36.84	35.53	ND	ND	33.75	36.36	33.05
EW-1	61.77	ND	ND	ND	ND	ND	46.92	51.17	55.35	52.20	47.15
EW-2	58.95	ND	ND	ND	ND	ND	36.60	39.25	54.25	40.89	40.95
EW-3	61.61	ND	ND	ND	ND	ND	46.21	ND	ND	46.87	52.46
EW-4	58.11	ND	ND	ND	ND	ND	37.54	35.51	53.98	40.33	36.19
EW-5	56.86	ND	ND	ND	ND	ND	49.86	52.66	53.86	44.35	ND
EW-6	56.6	ND	ND	ND	ND	ND	54.85	53.30	53.70	45.97	48.15
EW-7	67.55	ND	ND	ND	ND	ND	61.05	ND	59.70	60.44	58.01
EW-8	67.42	ND	ND	ND	ND	ND	62.47	ND	61.17	61.82	59.22
EW-9	67.33	ND	ND	ND	ND	ND	63.23	ND	61.90	62.60	59.90

NOTE: No water elevation data for MW-202 as this well is being utilized as a potable water supply well.
Elevations are ft msl ND = Not determined

Table 8. ANALYTICAL RESULTS - JUNE 1994 TO PRESENT
SHERWOOD MEDICAL INDUSTRIES NPL SITE

Surficial Aquifer Wells

Well ID	Parameter	6/94	12/94	6/95	12/95	6/96	12/96	6/97	12/97	6/98	12/98	6/99
MW-101	PCE	**21**	**6.6**	<13	**18.6**	**6.94**	**7.87**	**4.0**	**2.3**	**4.0I**	<3.0	**4.0I**
	TCE	**15**	**12**	**19**	**5.8**	**3.78**	**1.01**	<3.0	<3.0	<1.0	<1.0	1.0I
	Acetone	NA	NA	<500	<40	<40	<20	<9	<9	<25	<50	<50
	cis 1,2-DCE	**14.0**	**2.3**	<13	**1.22**	<1.0	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	trans 1,2-DCE	<1.0	<0.5	<13	<1.0	<1.0	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	VC	<1.0	0.50	<13	<1.0	<1.0	<0.50	<4.6	<4.6	<1.0	<1.0	<1.0
	Chromium	NA	NA	10.2	21.6	12.5	<10	24.1	15.2	<10	<10	<10
MW-102	PCE	**1,400**	**810**	**940**	**692**	**619**	**547**	**110**	**290**	**260**	**140**	**140**
	TCE	**62**	<50	<50	<50	<25	<25	**5.8**	**18**	**21**	**12**	**13**
	Acetone	NA	NA	<2000	<2000	<1000	<1000	<9	<18	<25	<50	<50
	cis 1,2-DCE	<50	<50	<50	<50	<25	<25	<2.4	**5.7**	**9.6**	**2.8I**	**4.5**
	trans 1,2-DCE	<50	<50	<50	<50	<25	<25	<2.4	<4.8	<1.0	<1.0	<1.0
	VC	<50	<50	<50	<50	<25	<25	<4.6	<9.2	<1.0	<1.0	<1.0
	Chromium	NA	NA	13.7	13.4	<10	<10	<10	<10	<10	<10	<10
MW-103	PCE	**8,600**	**3,800**	**3,700**	**3,890**	**3,030**	**2,380**	**4,100**	**790**	**1,000**	**320**	**1900**
	TCE	<250	<500	<250	<125	<125	<125	**100**	<30	**57**	**23**	**57**
	Acetone	NA	NA	<10000	<5000	<5000	<5000	<18	<90	<25	<50	<500
	cis 1,2-DCE	<250	<500	<250	<125	<125	<125	**150**	**61**	**30**	**14**	**14I**
	trans 1,2-DCE	<250	<500	<250	<125	<125	<125	**14**	<24	**1.6**	<1	<10
	VC	<250	<500	<250	<125	<125	<125	**10**	<46	**4.8**	**3.6**	<10
	Chromium	NA	NA	<10	<10	10.4	<10	10.5	<10	<10	<10	<10
MW-104	PCE	**700**	**400**	**450**	**506**	**360**	**312**	**120**	**170**	**400**	**32**	**220**
	TCE	**94**	**62**	**60**	**76.5**	**43.0**	**33.2**	**15**	**41**	**80**	**8.5**	**50**
	Acetone	NA	NA	<1000	<1000	<1000	<1000	<9	<9	<25	<50	<50
	cis 1,2-DCE	<25	**14**	<25	<25	<25	<25	**4.7**	**9.9**	**16**	**1.6I**	**9.7**
	trans 1,2-DCE	<25	<0.5	<25	<25	<25	<25	<2.4	<2.4	<1	<1	<1
	VC	<25	<0.50	<25	<25	<25	<25	<4.6	<4.6	<1.0	<1.0	<1.0
	Chromium	NA	NA	<10	<10	<10	<10	31.3	<10	<10	24	<10
MW-105	PCE	**300**	**83**	**54**	**127**	**43.9**	**50.1**	**110**	**210**	**550**	**180**	**320**
	TCE	**77**	**27**	**17**	**32.3**	**29.6**	**40.3**	**180**	**430**	**590**	**310**	**660**
	Acetone	NA	NA	<500	<200	<200	<100	<45	<45	<25	<50	<500
	cis 1,2-DCE	**120**	**44**	**36**	**50.5**	**84.1**	**63.1**	**610**	**730**	**530**	**150**	**600**
	trans 1,2-DCE	**13**	<0.5	<13	<5	<5	<2.5	<12	**12**	**13**	**3.6**	**15I**
	VC	<13	0.50	<13	**13.9**	**18.8**	**15.6**	**100**	**120**	**87**	**15**	**110**
	Chromium	NA	NA	<10	<10	13.6	<10	<10	<10	<10	<10	<10

Table 8. ANALYTICAL RESULTS - JUNE 1994 TO PRESENT
SHERWOOD MEDICAL INDUSTRIES NPL SITE

Surficial Aquifer Wells

Well ID	Parameter	6/94	12/94	6/95	12/95	6/96	12/96	6/97	12/97	6/98	12/98	6/99
MW-106	PCE	**3500**	**4,500**	**5,900**	**6,130**	**4,380**	**3,210**	**2,800**	**2,200**	**3,100**	**2000**	**2800**
	TCE	**190**	**150**	<250	<250	**133**	<125	**110**	**120**	**110**	**120**	**270**
	Acetone	NA	NA	<10000	<10000	<5000	<5000	<230	<230	<25	<50	<1000
	cis 1,2-DCE	<130	**27**	<250	<250	<125	<125	<60	<60	**22**	**30**	**80**
	trans 1,2-DCE	<130	<0.5	<250	<250	<125	<125	<60	<60	<2.6	**3.2**	<20
	VC	<130	0.50	<250	<250	<125	<125	<120	<120	<1.0	<1.0	<20
	Chromium	NA	NA	10	13	<10	<10	<10	39.1	<10	<10	<10
MW-107	PCE	**73**	**110**	**31**	**125**	**74.9**	**75.7**	**54**	**160**	**120**	**87**	**56**
	TCE	**4.2**	**6.2**	<2.5	**5.9**	<5.0	**9.15**	**7.5**	**18**	**19**	**16**	**13**
	Acetone	NA	NA	<100	<200	<200	<200	<9	<9	<25	<50	<50
	cis 1,2-DCE	<2.5	0.98	<2.5	<5.0	<5.0	<5.0	<2.4	**4.7**	**3.8**	**2.6I**	**2.1**
	trans 1,2-DCE	<2.5	<.05	<2.5	<5.0	<5.0	<5.0	<2.4	**<2.4**	**<1.0**	**<1.0**	<1.0
	VC	<2.5	<0.50	<2.5	<5.0	<5.0	<5.0	<4.6	<4.6	<1.0	<1.0	<1.0
	Chromium	NA	NA	99.8	70.1	<45.0	22.2	**111**	14.9	<10	98	34
MW-108	PCE	**950**	**600**	**79**	**623**	**587**	**680**	**460**	**410**	**510**	**310**	**290**
	TCE	**75**	**50**	**8.8**	**52**	**43.5**	**48.9**	**34**	**34**	**27**	**24**	**27**
	Acetone	NA	NA	<200	<1000	<1000	<1000	<45	<45	<25	**50**	<500
	cis 1,2-DCE	<50	<0.5	<5.0	<25	<25	<25	**<12**	<12	**2.4**	**2.4I**	<10
	trans 1,2-DCE	<50	<0.50	<5.0	<25	<25	<25	<12	<12	<1.0	<1.0	<10
	VC	<50	<0.50	<5.0	<25	<25	<25	**<23**	<23	<1.0	<1.0	<10
	Chromium	NA	NA	<10	<10	15.8	<10	10.3	<10	<10	10**I**	<10
MW-109	PCE	**210**	**150**	**170**	**139**	**117**	**107**	**61**	**50**	**68**	**31**	**20**
	TCE	**<50**	**5**	**6.1**	**5**	<5.0	**<5.0**	**<3.0**	<3.0	1.8	1.51	1.11
	Acetone	NA	NA	<200	<200	<200	<200	<9	<9	<25	<50	76
	cis 1,2-DCE	<50	**<0.50**	<5.0	<5.0	<5.0	<5.0	**<2.4**	<2.4	<1.0	**<1.0**	**<1.0**
	trans 1,2-DCE	<50	<0.50	<5.0	<5.0	<5.0	<5.0	<2.4	<2.4	<1.0	<1.0	<1.0
	VC	<50	<0.50	<5.0	<5.0	<5.0	<5.0	<4.6	<4.6	<1.0	<1.0	<1.0
	Chromium	NA	NA	<10.5	20.5	<79.3	36.5	37.2	20.6	<10	25	24
MW-110	PCE	**240**	**130**	**100**	**96.3**	**53.3**	**39.8**	**28**	**15**	**28**	**9.0**	**7.0I**
	TCE	**44**	**21**	**14**	**12.2**	**6.5**	**4.2**	**3.6**	<3.0	1.9	<1.0	1.0I
	Acetone	NA	NA	<500	<200	<200	<100	**<9**	<9	<25	**<50**	<50
	cis 1,2-DCE	<13.0	2.5	<13	<5.0	<5.0	**<2.5**	**<2.4**	**<2.4**	**<1.0**	<1.0	**<1.0**
	trans 1,2-DCE	<13.0	<0.5	<13	<5.0	<5.0	<2.5	<2.4	<2.4	<1.0	<1.0	<1.0
	VC	<13.0	<0.50	<13	**<5.0**	**<5.0**	<2.5	<4.6	<4.6	<1.0	<1.0	**<1.0**
	Chromium	NA	NA	<10	<10	<10	<10	<10	<10	10 **I**	<10	<10

Table 8. ANALYTICAL RESULTS - JUNE 1994 TO PRESENT
SHERWOOD MEDICAL INDUSTRIES NPL SITE

Surficial Aquifer Wells

Well ID	Parameter	6/94	12/94	6/95	12/95	6/96	12/96	6/97	12/97	6/98	12/98	6/99
MW-111	PCE	**60**	**30**	**25**	**15.9**	**13.8**	**14.3**	**3.2**	<1.9	**10**	**4.1**	**4.0I**
	TCE	**3.9**	2.7	<2.5	1.21	1.34	1.45	<3.0	<3.0	1.6 **I**	1.8I	**3.7**
	Acetone	NA	NA	<100	<20	<40	<20	<9	<9	<25	<50	<50
	cis 1,2-DCE	<2.5	<2.5	<2.5	<.50	<1.0	<0.50	<2.4	<2.4	<1.0	1.81	**3.2**
	trans 1,2-DCE	<2.5	<2.5	<2.5	<.50	<1.0	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	VC	<2.5	<2.5	<2.5	<.50	<1.0	<0.50	<4.6	<4.6	<1.0	<1.0	<1.0
	Chromium	NA	NA	**109**	17.3	14.2	<10	**161**	91.9	<10	65	<50
MW-112	PCE	**13**	<0.50	<1.0	**14.3**	**16.2**	**6.86**	**13**	**12**	**7.0 I**	**6.7**	**6.0I**
	TCE	**6.3**	**14**	**12**	2.24	1.4	1.16	<3.0	<3.0	<1.0	1.1**I**	1.0I
	Acetone	NA	NA	<40	<20	<20	<20	<9	<9	<25	<50	<50
	cis 1,2-DCE	<0.50	<0.50	<1.0	<0.50	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	trans 1,2-DCE	<0.50	<0.50	<1.0	<0.50	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	VC	<0.50	<0.50	<1.0	<0.50	<0.50	<0.50	<4.6	<4.6	<1.0	<1.0	<1.0
	Chromium	NA	NA	37.9	29.1	<10	11.3	13.2	17	<10	**190**	86
MW-113	PCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.9	<1.9	<2.0	<3.0	<3.0
	TCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<3.0	<3.0	<1.0	<1.0	<1.0
	Acetone	NA	NA	<20	<20	<20	<20	<9	<9	<25	<50	<50
	cis 1,2-DCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	trans 1,2-DCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	VC	<0.50	<0.50	<0.5077	<0.50	<0.50	<0.50	<4.6	<4.6	<1.0	<1.0	<1.0
	Chromium	NA	NA	6.4	29.2	**124**	87.5	76.7	23	14	13	10I
MW-114	PCE	<0.50	0.69	<2.5	<2.5	<2.5	<2.5	**110**	**71**	**120**	**62**	**35**
	TCE	2.4	0.87	<2.5	<2.5	<2.5	<2.5	**6.5**	**3.9**	**6.6**	**6.3**	**4.8**
	Acetone	NA	NA	<100	<100	<100	<100	<9	<9	<25	<50	<50
	cis 1,2-DCE	**5.3**	0.96	<2.5	<2.5	<2.5	<2.5	<2.4	<2.4	1.5 **I**	<**1.2I**	**1.2**
	trans 1,2-DCE	**0.63**	<0.50	<2.5	<2.5	<2.5	<2.5	<2.4	<2.4	<1.0	<1.0	<1.0
	VC	<0.50	<0.50	<2.5	<2.5	<2.5	<2.5	4.6	<4.6	<1.0	<1.0	<1.0
	Chromium	NA	NA	<10	<0.5	<10	<10	<10	<10	28	<10	<10

Notes:

I-Laboratory qualifier indicates compound detected at concentration between Method Detection Level and Practical Quantitation Level.

All results reported in µg/l. Acetone & Chromium not analyzed until 6/95 sampling.

TCE = trichloroethene

PCE = tetrachloroethene

VC = Vinyl Chloride

Analytical results in **bold** exceed cleanup criteria established in Record of Decision.

Cleanup Criteria: PCE-3 µg/l, TCE-3 µg/l, DCE-3 µg/l, Acetone-700 µg/l, VC-1 µg/l, Chromium-100 µg/l .

Source : ESE 1999

Table 8. ANALYTICAL RESULTS - JUNE 1994 TO PRESENT
SHERWOOD MEDICAL INDUSTRIES NPL SITE

Lower Floridian Aquifer

	Parameter	6/94	12/94	6/95	12/95	6/96	12/96	6/97	12/97	6/98	12/98	6/99
MW-202	PCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.9	<1.9	<2.0	<3.0	<3.0
	TCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<3.0	<3.0	<1.0	<1.0	<1.0
	Acetone	NA	NA	<20	<20	<20	<20	<9.0	<9.0	<25	<50	<50
	cis 1,2-DCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	trans 1,2-DCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	VC	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<4.6	<4.6	<1.0	<1.0	<1.0
MW-203	PCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.9	<1.9	<2.0	<3.0	<3.0
	TCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<3.0	<3.0	<1.0	<1.0	<1.0
	Acetone	NA	NA	<20	31.1	<20	<20	12	20	71	<50	<50
	cis 1,2-DCE	**0.60**	**0.76**	<0.50	**0.52**	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	trans 1,2-DCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	VC	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<4.6	<4.6	<1.0	<1.0	<1.0
MW-205	PCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.9	<1.9	<2.0	<3.0	<3.0
	TCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<3.0	<3.0	<1.0	<1.0	<1.0
	Acetone	NA	NA	<20	65.4	<20	<20	29	25	35	<50	<50
	cis 1,2-DCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	trans 1,2-DCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	VC	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<4.6	<4.6	<1.0	<1.0	<1.0
SMWS	PCE	**46**	**32**	**24**	**7.6**	**4.05**	2.64	<1.9	<1.9	<2.0	<3.0	<3.0
	TCE	**87**	**120**	**99**	**88.5**	**80.9**	**83.2**	**92**	**91**	**74**	**65**	**69**
	Acetone	NA	NA	<100	<200	<20	<100	<9.0	<9.0	<25	<50	<50
	cis 1,2-DCE	**18**	**25**	**24**	**21.2**	**19.7**	**25.9**	**35**	**46**	**39**	**33**	**49**
	trans 1,2-DCE	<13	<5	<2.5	<5.0	**1.11**	<2.5	<2.4	**2.4**	**1.7I**	**1.4I**	**1.9I**
	VC	<0.50	<0.50	<2.5	<5.0	0.95	<0.50	<4.6	<4.6	**1.5 I**	**1.1I**	**1.5I**
SMFW	PCE	1.1	**17**	1.9	<1.0	1.21	1.66	<1.9	<1.9	<2.0	<3.0	<3.0
	TCE	**5.4**	**43**	**18**	**6.02**	2.55	**3.85**	<3.0	**8.9**	**13**	**10**	**9.6**
	Acetone	NA	NA	<40	<40	<20	<20	<9.0	<9.0	<25	<50	<50
	cis 1,2-DCE	**4.0**	**11**	**8.2**	**7.28**	**3.43**	**4.39**	**2.5**	**5.9**	**8.1**	**5.8**	**14**
	trans 1,2-DCE	<0.50	1	<1.0	<1.0	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	VC	<0.50	<0.50	<0.50	<1.0	<0.50	<0.50	<4.6	<4.6	<1.0	<1.0	**1.4I**

Notes:

I-Laboratory qualifier indicates compound detected at concentration between Method Detection Level and Practical Quantitation Level.

All results reported in µg/l. Acetone not analyzed until 6/95 sampling.

TCE = trichloroethene

PCE = tetrachloroethene

VC = Vinyl Chloride

Analytical results in **bold** exceed cleanup criteria established in Record of Decision.

Cleanup Criteria: PCE-3 µg/l, TCE-3 µg/l, DCE-3 µg/l, Acetone-700 µg/l, VC-1 µg/l, Chromium-100 µg/l .

Source : ESE 1999

Table 8. ANALYTICAL RESULTS - JUNE 1994 TO PRESENT
SHERWOOD MEDICAL INDUSTRIES NPL SITE

Upper Floridian Aquifer

Well ID	Parameter	6/94	12/94	6/95	12/95	6/96	12/96	6/97	12/97	6/98	12/98	6/99
MW-201	PCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.9	<1.9	<2.0	<3.0	<3.0
	TCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<3.0	<3.0	<1.0	<1.0	<1.0
	Acetone	NA	NA	<20	<20	<20	<20	16	16	38	160	70
	cis 1,2-DCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.4	<2.4		<1.0	<1.0
	trans 1,2-DCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.4	<2.4	<2.0	<1.0	<1.0
	VC	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<4.6	<4.6	<1.0	<1.0	<1.0
MW-204	PCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.9	<1.9	<2.0	<3.0	<3.0
	TCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<3.0	<3.0	<1.0	<1.0	<1.0
	Acetone	NA	NA	<20	<20	<20	108	40	<9	**<25**	640	<50
	cis 1,2-DCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	trans 1,2-DCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	VC	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<4.6	<4.6	<1.0	<1.0	<1.0
FA-1	PCE	<1.0	<0.50	<1.0	<2.20	<0.50	<1.0	<1.9	<1.9	<2.0	<3.0	<3
	TCE	**26**	**19**	**34**	**19**	**34.7**	**12.7**	**9.0**	**24**	<1.0	**23**	**28**
	Acetone	NA	NA	<40	43.3	<20	94.5	23	16	**1,700**	120	<50
	cis 1,2-DCE	**17.7**	**17**	**16**	**16.5**	**15.3**	**6.84**	**7.0**	**27**	<1.0	**18**	**29**
	trans 1,2-DCE	<1.0	1.8	**2.1**	**2.2**	**2.01**	**1.09**	<2.4	<2.4	<1.0	1.5I	2.2I
	VC	<1.0	<0.50	<1.0	**1.04**	0.9	**1.27**	<4.6	<4.6	**7.4**	<1.0	<1.0
FA-2	PCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<3.8	<3.8	<2.0	<3.0	<3.0
	TCE	<0.50	1.8	<0.50	<0.50	<0.50	<0.50	<6.0	<6.0	<1.0	<1.0	<1.0
	Acetone	NA	NA	340	**1,950**	123	163	250	43	**1,100**	**730**	<240
	cis 1,2-DCE	**3.6**	**75**	**3.2**	0.85	1.29	1.14	<4.8	<4.8	<1.0	1.1I	**1.4I**
	trans 1,2-DCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<4.8	<4.8	<1.0	<1.0	<1.0
	VC	<0.50	1.6	<0.50	<0.50	<0.50	<0.50	<9.2	<9.2	<1.0	<1.0	<1.0
FA-3	PCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.9	<1.5	<2.0	<3.0	<3.0
	TCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<3.0	<3.0	<1.0	<1.0	<1.0
	Acetone	NA	NA	<20	26	<20	111	12	21	280	<50	85
	cis 1,2-DCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	trans 1,2-DCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	VC	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<4.6	<4.6	<1.0	<1.0	<1.0

Notes: **I**-Laboratory qualifier indicates compound detected at concentration between Method Detection Level and Practical Quantitation Level.

All results reported in µg/l. Acetone & Chromium not analyzed 6/95 sampling.

TCE = trichloroethene

PCE = tetrachloroethene

VC = Vinyl Chloride

Analytical results in **bold** exceed cleanup criteria established in Record of Decision.

Cleanup Criteria: PCE-3 µg/l, TCE-3 µg/l, DCE-3 µg/l, Acetone-700 µg/l, VC-1 µg/l, Chromium-100 µg/l . Source: ESE 1999

Table 8. ANALYTICAL RESULTS - JUNE 1994 TO PRESENT
SHERWOOD MEDICAL INDUSTRIES NPL SITE

Residential Potable Wells

Well ID	Parameter	6/94	12/94	6/95	12/95	6/96	12/96	6/97	12/97	6/98	12/98	6/99
FDOT	PCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.9	<1.9	<2.0	<3.0	<3.0
	TCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<3.0	<3.0	<1.0	<1.0	<1.0
	Acetone	NA	NA	<20	<20	<20	<20	<9.0	<9.0	<25	<50	<50
	cis 1,2-DCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	trans 1,2-DCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	VC	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<4.6	<4.6	<1.0	<1.0	<1.0
Fire Station	PCE	<0.50	<0.50	Well not Avail	Well not Avail	Well not Avail	Well not Avail	Well not Avail	Well not Avail	Well not Avail	Well not Avail	Well not Avail
	TCE	<0.50	<0.50									
	Acetone	NA	NA									
	cis 1,2-DCE	<0.50	<0.50									
	trans 1,2-DCE	<0.50	<0.50									
	VC	<0.50	<0.50									
Florist	PCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.9	<1.9	<2.0	<3.0	<3.0
	TCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<3.0	<3.0	<1.0	<1.0	<1.0
	Acetone	NA	NA	<20	<20	<20	<20	<9.0	<9.0	<25	<50	<50
	cis 1,2-DCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	trans 1,2-DCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	VC	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<4.6	<4.6	<1.0	<1.0	<1.0
Mills	PCE	<0.50	<0.50	<0.50	<0.50	Well not Avail	Well not Avail	Well not Avail	Well not Avail	Well not Avail	Well not Avail	Well not Avail
	TCE	<0.50	<0.50	<0.50	<0.50							
	Acetone	NA	NA	NA	<20							
	cis 1,2-DCE	<0.50	<0.50	<0.50	<0.50							
	trans 1,2-DCE	<0.50	<0.50	<0.50	<0.50							
	VC	<0.50	<0.50	<0.50	<0.50							
Tavern	PCE	<0.50	<0.50	Well Destroyed	Well Destroyed	Well Destroyed	Well Destroyed	Well Destroyed	Well Destroyed	Well Destroyed	Well Destroyed	Well Destroyed
	TCE	<0.50	<0.50									
	Acetone	NA	NA									
	cis 1,2-DCE	<0.50	<0.50									
	trans 1,2-DCE	<0.50	<0.50									
	VC	<0.50	<0.50									

Table 8. ANALYTICAL RESULTS - JUNE 1994 TO PRESENT
SHERWOOD MEDICAL INDUSTRIES NPL SITE

Residential Potable Wells

Well ID	Parameter	6/94	12/94	6/95	12/95	6/96	12/96	6/97	12/97	6/98	12/98	6/99
Woods	PCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<1.9	<1.9	<2.0	<3.0	<3.0
	TCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<3.0	<3.0	<1.0	<1.0	<1.0
	Acetone	NA	NA	<20	<20	<20	<20	<9.0	<9.0	<25	<50	<50
	cis 1,2-DCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	trans 1,2-DCE	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	VC	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<4.6	<4.6	<1.0	<1.0	<1.0
Lang	PCE	1.7	1.7	2.4	2.05	**3.13**	Well	Well	Well	Well	Well	Well
	TCE	1.2	1.4	1.7	1.85	2.42	Destroyed	Destroyed	Destroyed	Destroyed	Destroyed	Destroyed
	Acetone	NA	NA	<20	<20	<20						
	cis 1,2-DCE	0.64	0.63	0.72	0.73	0.73						
	trans 1,2-DCE	<0.50	<0.50	<0.50	<0.50	<0.50						
	VC	<0.50	<0.50	<0.50	<0.50	<0.50						

Notes:

I-Laboratory qualifier indicates compound detected at concentration between Method Detection Level and the Practical Quantitation Level.

All results reported in µg/l. Acetone & Chromium not analyzed until 6/95 sampling.

DCE = Total CIS-1,2 & Trans-1,2 Dichloroethene

TCE = trichloroethene

PCE = tetrachloroethene

VC = Vinyl Chloride

Analytical results in **bold** exceed cleanup criteria established in Record of Decision.

Cleanup Criteria: PCE-3 µg/l, TCE-3 µg/l, DCE-3 µg/l, Acetone-700 µg/l, VC-1 µg/l, Chromium-100 µg/l .

Source: ESE 1999

Table 8. ANALYTICAL RESULTS - JUNE 1994 TO PRESENT
SHERWOOD MEDICAL INDUSTRIES NPL SITE

Extraction Wells

Well ID	Parameter	6/94	12/94	6/95	12/95	6/96	12/96	6/97	12/97	6/98	12/98	6/99
EW-1	PCE	NA	NA	NA	NA	NA	NA	NA	NA	**5.0 I**	**52**	**72**
	TCE	NA	NA	NA	NA	NA	NA	NA	NA	<1.0	**11**	**10**
	Acetone	NA	NA	NA	NA	NA	NA	NA	NA	<25	<50	<50
	cis 1,2-DCE	NA	NA	NA	NA	NA	NA	NA	NA	<1.0	<1.0	1.9
	trans 1,2-DCE	NA	NA	NA	NA	NA	NA	NA	NA	<1.0	<1.0	1.0
	VC	NA	NA	NA	NA	NA	NA	NA	NA	<1.0	<1.0	1.0
EW-2	PCE	NA	NA	NA	NA	NA	NA	NA	NA	**1,600**	**320**	**510**
	TCE	NA	NA	NA	NA	NA	NA	NA	NA	**78**	**20**	**33**
	Acetone	NA	NA	NA	NA	NA	NA	NA	NA	<25	<50	<1000
	cis 1,2-DCE	NA	NA	NA	NA	NA	NA	NA	NA	**38**	**8.9**	**24**
	trans 1,2-DCE	NA	NA	NA	NA	NA	NA	NA	NA	**1.4I**	<1.0	20
	VC	NA	NA	NA	NA	NA	NA	NA	NA	**2.1**	**1.4I**	20
EW-3	PCE	NA	NA	NA	NA	NA	NA	NA	NA	**5,500**	**710**	ND
	TCE	NA	NA	NA	NA	NA	NA	NA	NA	**270**	**52**	ND
	Acetone	NA	NA	NA	NA	NA	NA	NA	NA	<25	<50	ND
	cis 1,2-DCE	NA	NA	NA	NA	NA	NA	NA	NA	**350**	**30**	ND
	trans 1,2-DCE	NA	NA	NA	NA	NA	NA	NA	NA	**47**	**6.3**	ND
	VC	NA	NA	NA	NA	NA	NA	NA	NA	<1.0	<1.0	ND
EW-4	PCE	NA	NA	NA	NA	NA	NA	NA	NA	**82**	**35**	**37**
	TCE	NA	NA	NA	NA	NA	NA	NA	NA	**34**	**10**	**15**
	Acetone	NA	NA	NA	NA	NA	NA	NA	NA	<25	<50	<50
	cis 1,2-DCE	NA	NA	NA	NA	NA	NA	NA	NA	**39**	**13**	**18**
	trans 1,2-DCE	NA	NA	NA	NA	NA	NA	NA	NA	<1.0	<1.0	<1.0
	VC	NA	NA	NA	NA	NA	NA	NA	NA	<1.0	**1.2I**	**2**
EW-5	PCE	NA	NA	NA	NA	NA	NA	NA	NA	**77**	**65**	**74**
	TCE	NA	NA	NA	NA	NA	NA	NA	NA	**9.8**	**13**	**41**
	Acetone	NA	NA	NA	NA	NA	NA	NA	NA	<25	<50	<50
	cis 1,2-DCE	NA	NA	NA	NA	NA	NA	NA	NA	<1.0	**6.2**	**39**
	trans 1,2-DCE	NA	NA	NA	NA	NA	NA	NA	NA	<1.0	<1.0	1.6
	VC	NA	NA	NA	NA	NA	NA	NA	NA	<1.0	<1.0	**9**
EW-6	PCE	NA	NA	NA	NA	NA	NA	NA	NA	**100**	<3.0	**3**
	TCE	NA	NA	NA	NA	NA	NA	NA	NA	**5.6**	<1.0	<1.0
	Acetone	NA	NA	NA	NA	NA	NA	NA	NA	<25	<50	<50
	cis 1,2-DCE	NA	NA	NA	NA	NA	NA	NA	NA	**6.2**	<1.0	<1.0
	trans 1,2-DCE	NA	NA	NA	NA	NA	NA	NA	NA	<1..0	<1.0	<1.0
	VC	NA	NA	NA	NA	NA	NA	NA	NA	<1.0	<1.0	<1.0

Table 8. ANALYTICAL RESULTS - JUNE 1994 TO PRESENT
SHERWOOD MEDICAL INDUSTRIES NPL SITE

Extraction Wells

Well ID	Parameter	6/94	12/94	6/95	12/95	6/96	12/96	6/97	12/97	6/98	12/98	6/99
EW-7	PCE	NA	NA	NA	NA	NA	NA	NA	NA	<2.0	**12**	**23**
	TCE	NA	NA	NA	NA	NA	NA	NA	NA	**3.6**	**4.4**	**10**
	Acetone	NA	NA	NA	NA	NA	NA	NA	NA	<25	<50	<50
	cis 1,2-DCE	NA	NA	NA	NA	NA	NA	NA	NA	**1.5 I**	<1.0	**4.4**
	trans 1,2-DCE	NA	NA	NA	NA	NA	NA	NA	NA	<1.0	<1.0	<1.0
	VC	NA	NA	NA	NA	NA	NA	NA	NA	<1.0	<1.0	<1.0
EW-8	PCE	NA	NA	NA	NA	NA	NA	NA	NA	**40**	<3.0	**23**
	TCE	NA	NA	NA	NA	NA	NA	NA	NA	**11**	<1.0	**20**
	Acetone	NA	NA	NA	NA	NA	NA	NA	NA	<25	<50	<50
	cis 1,2-DCE	NA	NA	NA	NA	NA	NA	NA	NA	**12**	**5.5**	**15**
	trans 1,2-DCE	NA	NA	NA	NA	NA	NA	NA	NA	<1.0	<1.0	<1.0
	VC	NA	NA	NA	NA	NA	NA	NA	NA	<1.0	<1.0	<1.0
EW-9	PCE	NA	NA	NA	NA	NA	NA	NA	NA	**26**	**9.7**	<3.0
	TCE	NA	NA	NA	NA	NA	NA	NA	NA	**3.9**	**3.0**	**6.8**
	Acetone	NA	NA	NA	NA	NA	NA	NA	NA	<25	<50	<50
	cis 1,2-DCE	NA	NA	NA	NA	NA	NA	NA	NA	1.6 **I**	1.8**I**	**4.7**
	trans 1,2-DCE	NA	NA	NA	NA	NA	NA	NA	NA	<1.0	<1.0	<1.0
	VC	NA	NA	NA	NA	NA	NA	NA	NA	<1.0	<1.0	<1.0

Notes

Extraction wells not sampled prior to June 1998.

I-Laboratory qualifier indicates compound detected at concentration between Method Detection Level and Practical Quantitation Level.

All results reported in µg/l.

TCE = trichloroethene

PCE = tetrachloroethene

VC = Vinyl Chloride

Analytical results in **bold** exceed cleanup criteria established in Record of Decision.

Cleanup Criteria: PCE-3 µg/l, TCE-3 µg/l, DCE-3 µg/l, Acetone-700 µg/l, VC-1 µg/l, Chromium-100 µg/l .

Source: ESE 1999

Table 8. ANALYTICAL RESULTS - JUNE 1994 TO PRESENT
SHERWOOD MEDICAL INDUSTRIES NPL SITE

Groundwater Treatment System

Well ID	Parameter	6/94	12/94	6/95	12/95	6/96	12/96	6/97	12/97	6/98	12/98	6/99
Air	PCE	NA	NA	**500**	**429**	**380**	**376**	**320**	**650**	**1,100**	**240**	**130**
Stripper	TCE	NA	NA	**27**	<25	<25	<25	**26**	**31**	**50**	**19**	**25**
Influent	Acetone	NA	NA	<1000	<1000	<1000	<1000	<24	<24	<25	<50	<500
	cis 1,2-DCE	NA	NA	<25	<25	<25	<25	**27**	**28**	**38**	**11**	**20**
	trans 1,2-DCE	NA	NA	<25	<25	<25	<25	<**12**	<**12**	<1.0	**1.1I**	<10
	VC	NA	NA	<25	<25	<25	<25	<23	<23	<1.0	**1.3I**	<10
Air	PCE	**32**	**17**	0.69	**4.69**	<0.50	**3.26**	<1.9	<1.9	<2.0	<3.0	<3.0
Stripper	TCE	<13	<2.5	<0.50	<0.50	<0.50	<0.50	<3.0	<3.0	<1.0	<1.0	<1.0
Effluent	Acetone	NA	NA	<20	<20	<20	<20	<9.0	<9.0	<25	<50	<50
	cis 1,2-DCE	<13	<2.5	<0.50	0.62	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	trans 1,2-DCE	<13	<2.5	<0.50	<0.50	<0.50	<0.50	<2.4	<2.4	<1.0	<1.0	<1.0
	VC	<13	<2.5	<0.50	<0.50	<0.50	<0.50	<4.6	<4.6	<1.0	<1.0	<1.0

Notes

Laboratory qualifier indicates compound detected at concentration between Method Detection Level and Practical Quantitation Level.

All results reported in µg/l. Acetone & Chromium not analyzed until 6/95 sampling.

DCE = Total CIS-1,2 & Trans-1,2 Dichloroethene

TCE = trichloroethene

PCE = tetrachloroethene

VC = Vinyl Chloride

NA = Not analyzed

Analytical results in **bold** exceed cleanup criteria established in Record of Decision.

Cleanup Criteria: PCE-3 µg/l, TCE-3 µg/l, DCE-3 µg/l, Acetone-700 µg/l, VC-1 µg/l, Chromium-100 µg/l .

Source: ESE 1999

Table 9 - Estimated Contaminant Removal

Influent Concentration - Shallow Aquifer Recovery System

		Sample Date													
COC		Jul-92	Jun-93	Nov-93	Jun-94*	Jan-95*	Jun-95	Dec-95	Jun-96	Dec-96	Jun-97	Dec-97	Jun-98	Dec-98	Jun-99
PCE	ug/l	620	223	214	300	400	500	429	360	376	320	650	1100	240	130
TCE	ug/l	52	17	28	28	27	27	<25	<25	<25	<3	31	50	19	25
DCE	ug/l	22	<0.5	<0.5	<0.5	<25	<25	<25	<25	<25	27	28	38	12	20
VC	ug/l	<2	<2	<0.5	<0.5	<25	<25	<25	<75	<25	<4.6	<23	<1	1.3	<10
Acetone	ug/l	<50	<50	<2.5	<2.5	<1000	<1000	<1000	<1000	<1000	<24	<24	<25	<50	<50
Influent Rate (gpm)		200	200	200	200	200	200	200	200	200	200	150	150	150	150

Influent Concentration - Floridan Aquifer Supply Well

		Sample Date													
COC		Jan-91	Jun-93	Dec-93	Jun-94	Dec-94	Jun-95	Dec-95	Jun-96	Dec-96	Jun-97	Dec-97	Jun-98	Dec-98	Jun-99
PCE	ug/l	46	40	45	46	32	24	8	4	3	<1.9	<1.9	<2.0	<3.0	<3.0
TCE	ug/l	58	66	103	87	120	99	89	81	83	91	91	74	65	69
DCE	ug/l	14	0	0	18	25	24	21	21	26	48	48	41	34	51
VC	ug/l	0	0	0	<0.50	<0.50	<2.5	<5.0	1	<0.50	<4.6	<4.6	1.5	1	1.5
Acetone	ug/l	<50	<50	<2.5	NA	NA	<100	<200	<20	<100	<9.0	<9.0	<25	<50	<50
Influent Rate (gpm)		300	300	300	300	300	300	300	300	300	300	300	300	300	300

Contaminant Recovery Estimate - Shallow Aquifer

															Est. Total
lbs PCE	196	94	132	175	219	188	158	165	140	214	362	79	43	2164
lbs TCE	15	12	12	12	12	5	5	5	1	10	16	6	8	121
lbs DCE	0	0	0	5	5	5	5	5	12	9	12	4	7	71

Contaminant Recovery Estimate - Floridan Aquifer

														Est. Total
lbs PCE	303	79	30	30	21	16	5	3	2	1	1	1	1	493
lbs TCE	383	130	68	57	79	65	59	53	55	61	60	49	43	45	1205
lbs DCE	92	0	0	12	16	16	14	14	17	23	32	27	22	34	319

Notes:

Assumptions/generalizations

- Assumes continuous recovery/treatment rate
- Recovery rate dropped when 3 recovery wells were discontinued in 1997
- Assumes contaminant concentration measured mid year constant for entire year
- * No samples collected. Concentration interpolated from data available from previous and following sampling
- Non detect estimated at 1/2 detection limit
- Floridan Aquifer June 91 estimate assumes constant concentration from system startup in 1986
- No calculations made for COC's Acetone, vinyl chloride or chromium

COC Contaminant of Concern
ug/l microgram/liter
PCE Tetrachloroethene
TCE Trichloroethene
DCE Dichloroethene

FIGURES

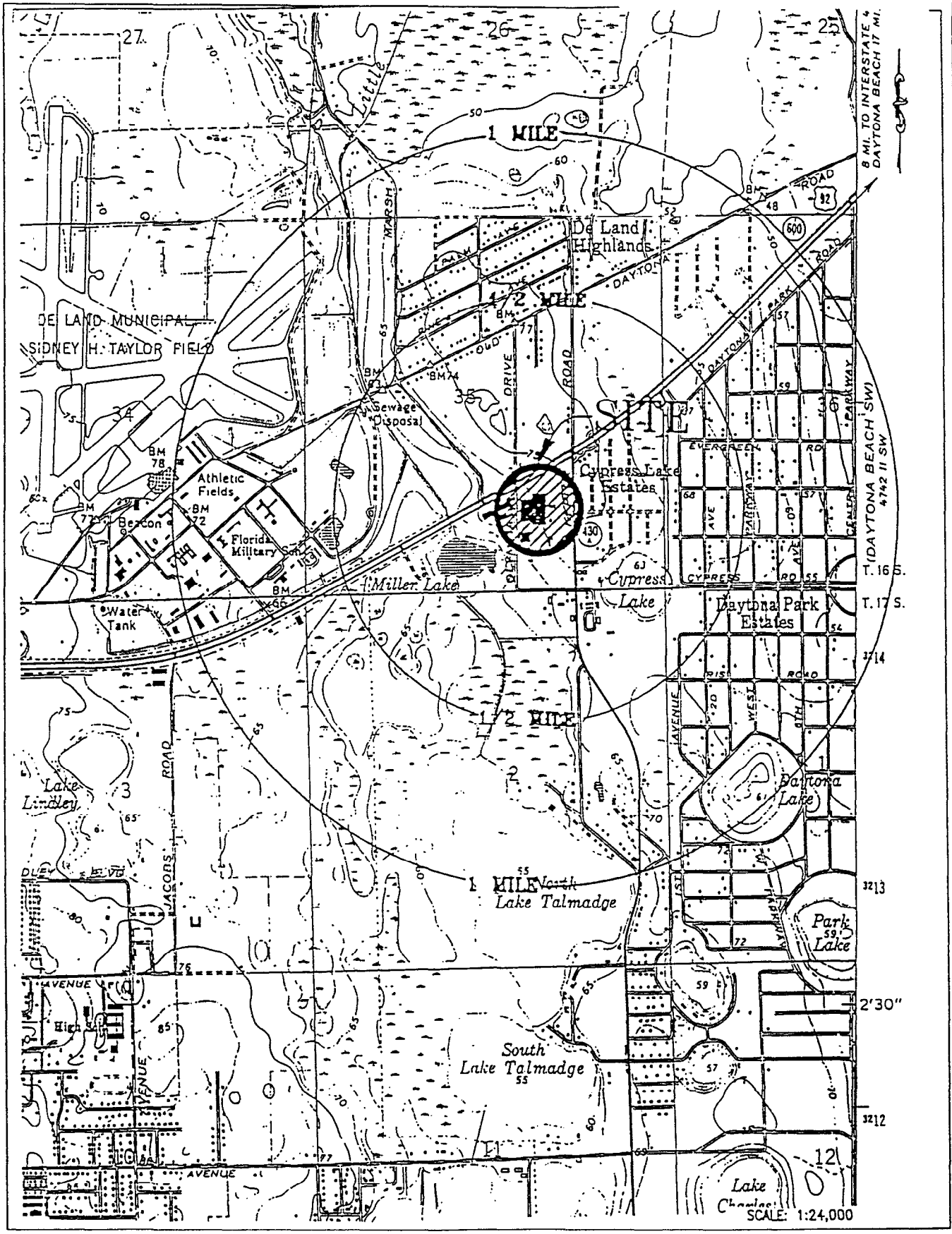


Figure 1
SITE LOCATION MAP
SHERWOOD MEDICAL INDUSTRIES

DELAND, FLORIDA Source: ESE, 1999.

Project No.:	3698019-0500
Date:	September 1999
Drawn By:	D.J.T.
Checked By:	M.J.G.
Approved By:	M.J.G.

AMERICAN HOME PRODUCTS

PLOTTED:Sept 30, 1999 - 17:42:47
1998\3698019\O&M\CADD\SITELOC

REVIEW\DISSITE

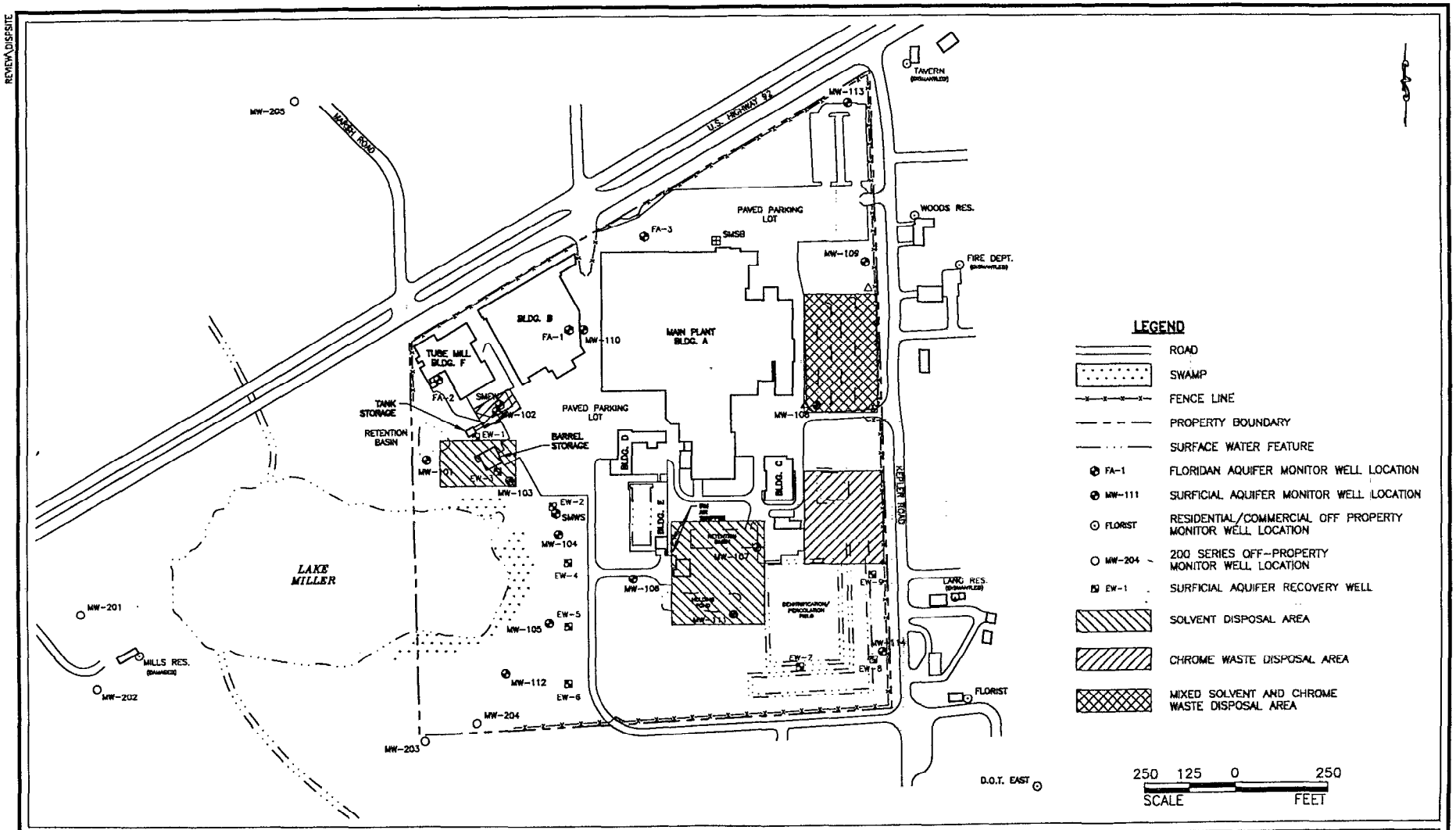


Figure 2
DISPOSAL SITE LOCATIONS AS PRESENTED IN THE RECORD OF DECISION
SHERWOOD MEDICAL INDUSTRIES
DELAND, FLORIDA

Source: ESE, 1999.

Project No.:	3698019-0X00
Date:	October 1999
Drawn By:	D.J.T.
Checked By:	M.J.G.
Approved By:	M.J.G.

AMERICAN HOME PRODUCTS, CORP.

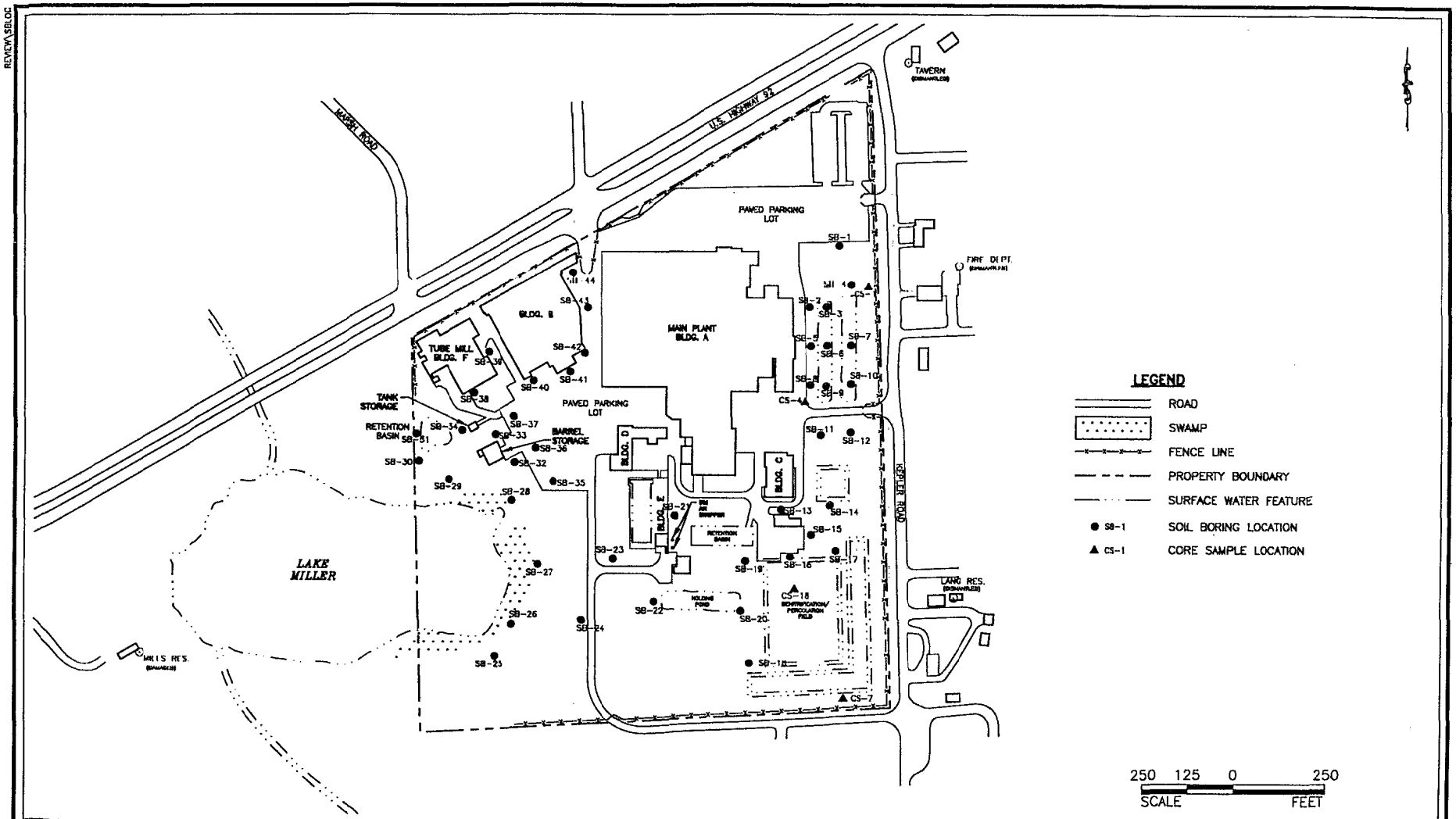


Figure 3
SOIL BORING LOCATIONS – REMEDIAL INVESTIGATION PROGRAM
SHERWOOD MEDICAL INDUSTRIES
DELAND, FLORIDA

Source: ESE, 1999.

Project No.:	3698019-0X00
Date:	October 1999
Drawn By:	D.J.T.
Checked By:	M.J.G.
Approved By:	M.J.G.

AMERICAN HOME PRODUCTS, CORP.

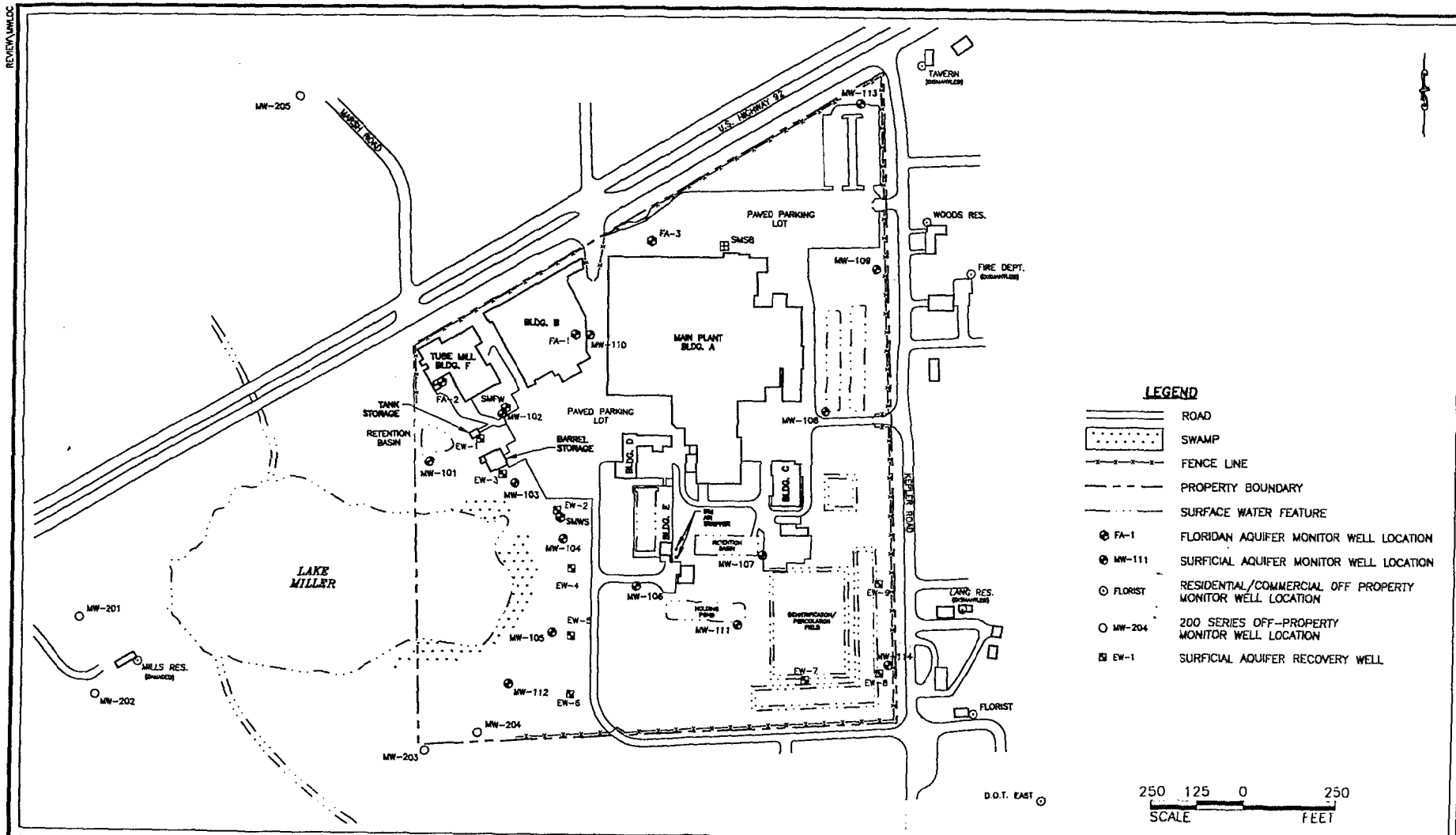


Figure 4
GROUNDWATER MONITOR AND RECOVERY WELL LOCATIONS – REMEDIAL INVESTIGATION
SHERWOOD MEDICAL INDUSTRIES
DELAND, FLORIDA

Source: ESE, 1999.

Project No.:	3698019-0X00
Date:	October 1999
Drawn By:	D.J.T.
Checked By:	M.J.G.
Approved By:	M.J.G.

AMERICAN HOME PRODUCTS, CORP.

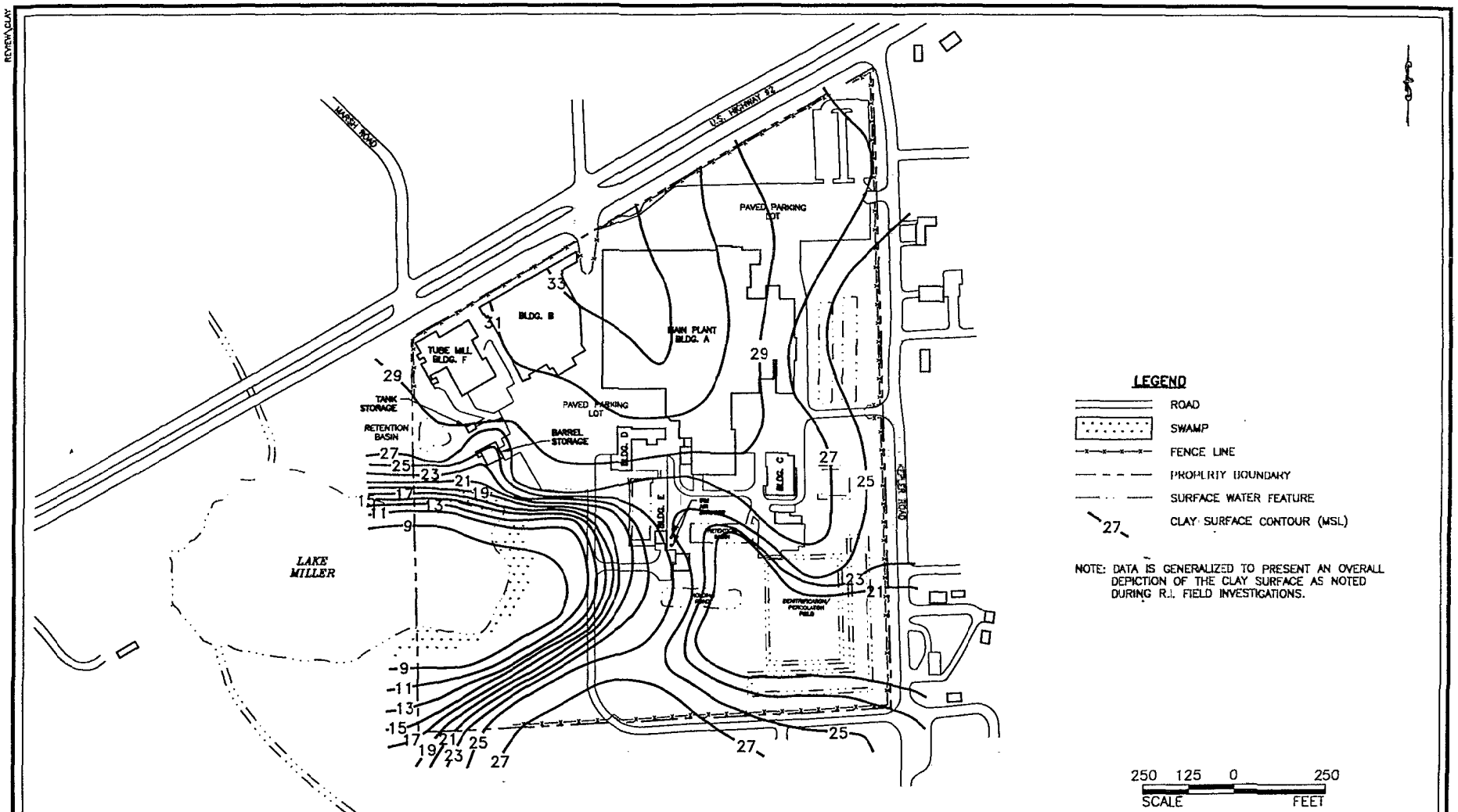


Figure 5
TOP OF CLAY ISOPLETH MAP – REMEDIAL INVESTIGATION
SHERWOOD MEDICAL INDUSTRIES
DELAND, FLORIDA

Source: ESE, 1999.

Project No.:	3695019--0X00
Date:	October 1999
Drawn By:	D.J.T.
Checked By:	M.J.G.
Approved By:	M.J.G.

AMERICAN HOME PRODUCTS, CORP.

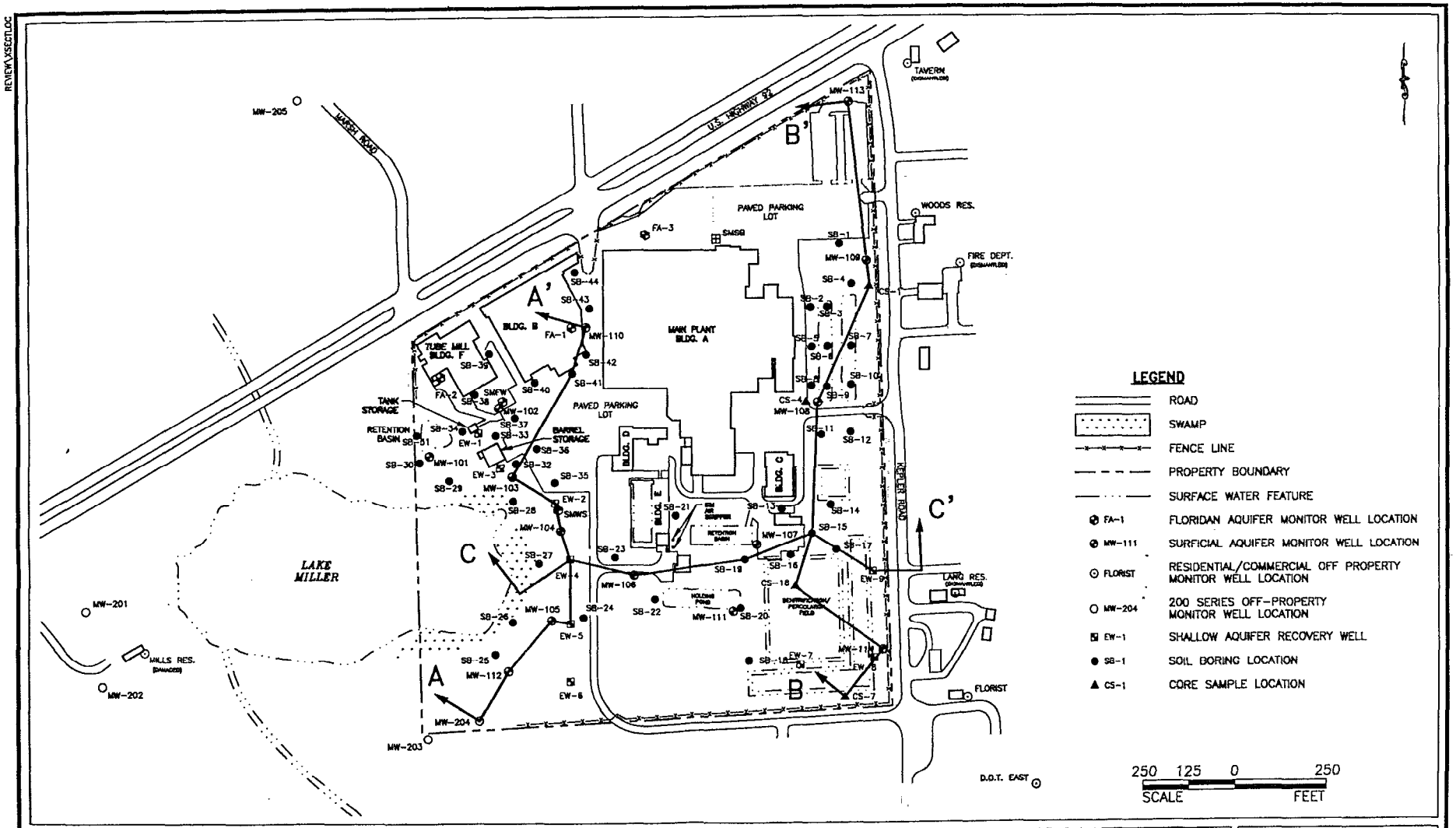


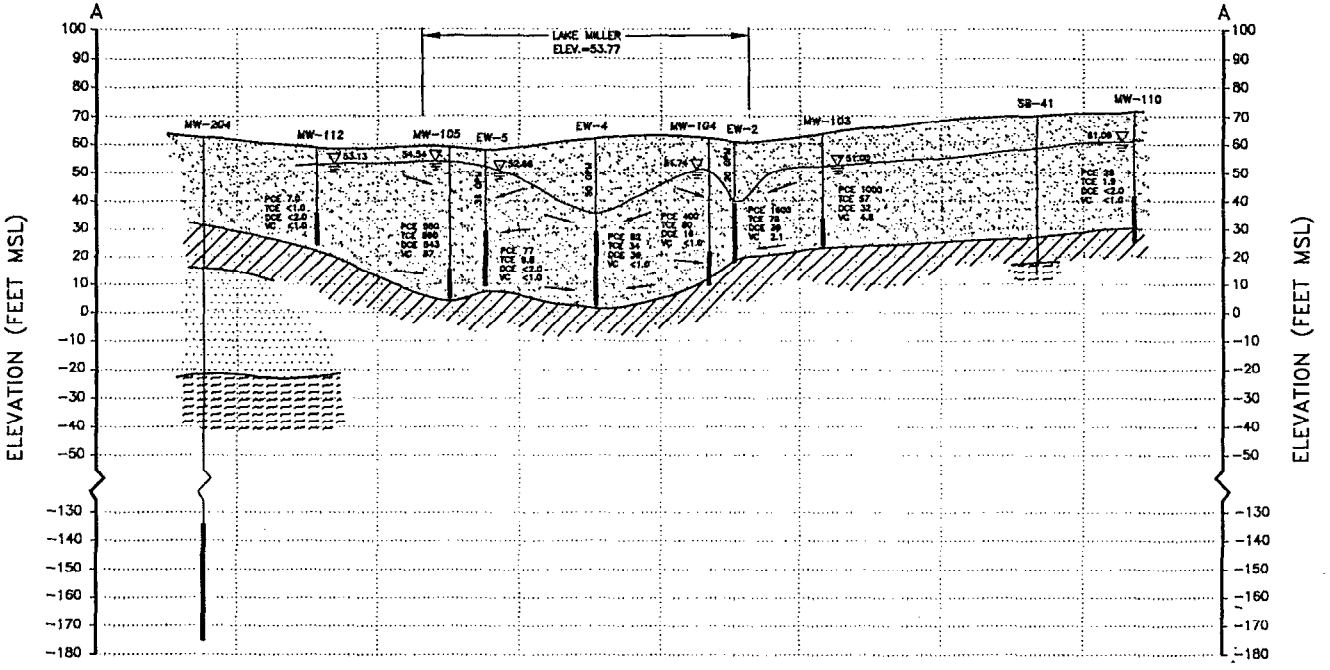
Figure 6
CROSS SECTION LOCATION MAP
SHERWOOD MEDICAL INDUSTRIES
DELAND, FLORIDA

Source: ESE, 1999.

Project No.:	3698019-0X00
Date:	October 1999
Drawn By:	D.J.T.
Checked By:	M.J.G.
Approved By:	M.J.G.

AMERICAN HOME PRODUCTS, CORP.

REVIEW\XSECTA-A



LEGEND

- GROUNDWATER FLOW DIRECTION *
- WATER ELEVATION ON 6/5/98
- WELL SCREEN INTERVAL
- 50 GPM WELL PUMPING RATE (6/99)
- GROUNDWATER ANALYTICAL DATA (?g/L) - 6/98
- SAND/SILTY SAND
- SAND w/ SHELL
- LIMESTONE
- CLAY

* GROUNDWATER FLOW AS DEPICTED REPRESENTS A SCHEMATIC TWO-DIMENSIONAL FLOW ALONG THE AXIS OF THE CROSS SECTION. THIS DEPICTION IS GRAPHIC ONLY AND DOES NOT REPRESENT ACTUAL FLOW OR MAGNITUDE.

80 40 0 80
SCALE HORIZONTAL FEET

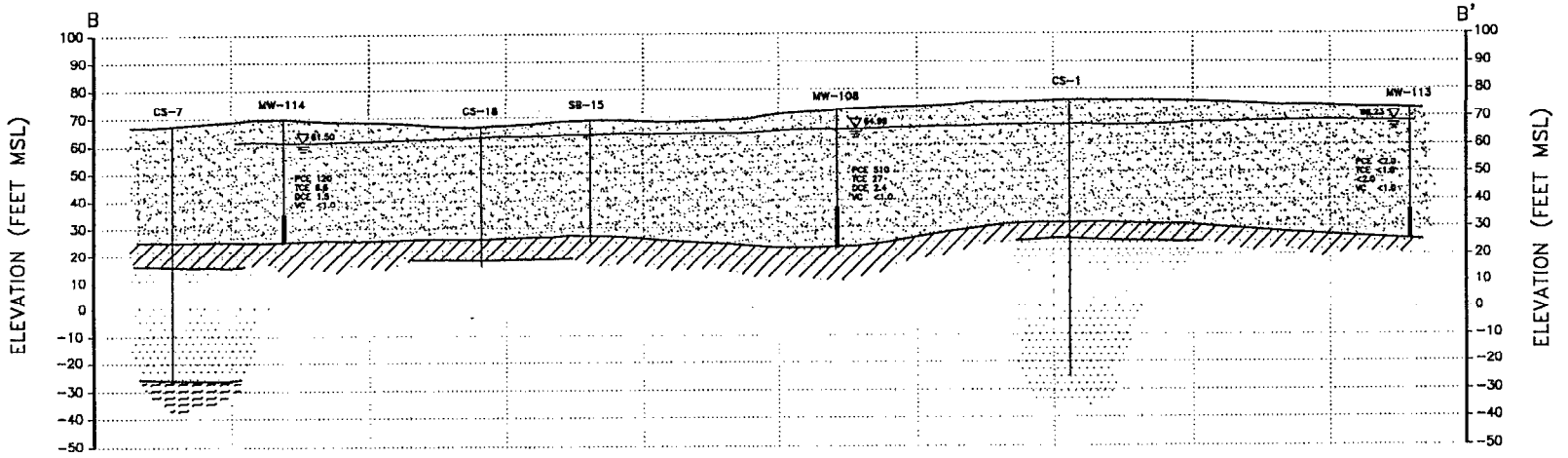
Figure 7
CROSS SECTION A-A'
SHERWOOD MEDICAL INDUSTRIES
DELAND, FLORIDA

Source: ESE, 1999.

Project No.	3698019-0X00
Date	October 1999
Drawn By	D.J.T.
Checked By	M.J.G.
Approved By	M.J.G.

AMERICAN HOME PRODUCTS, CORP.

REVIEW\XSECTB-B



LEGEND

- WATER ELEVATION ON 6/5/98
- WELL SCREEN INTERVAL
- SAND/SILTY SAND
- SAND w/ SHELL
- LIMESTONE
- CLAY

GROUNDWATER ANALYTICAL DATA (?g/L) - 6/98

* NO GROUNDWATER FLOW DIRECTION IMPLIED ON THIS CROSS SECTION.

80 40 0 80

SCALE HORIZONTAL FEET

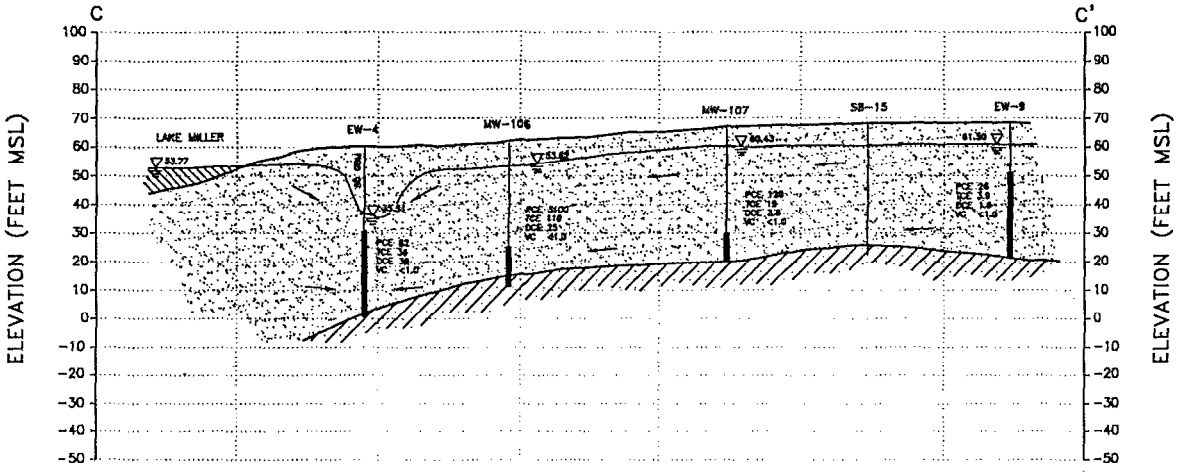
Figure 8
CROSS SECTION B-B'
SHERWOOD MEDICAL INDUSTRIES
DELAND, FLORIDA

Source: ESE, 1999.

Project No.	3698019-0X00
Date	October 1999
Drawn By	D.J.T.
Checked By	M.J.G.
Approved By	M.J.G.

AMERICAN HOME PRODUCTS, CORP.

REVIEW\XSECTC-C



LEGEND

- GROUNDWATER FLOW DIRECTION *
- WATER ELEVATION ON 6/5/98
- WELL SCREEN INTERVAL
- 50 GPM — WELL PUMPING RATE (6/99)
- SAND/SILTY SAND
- SAND w/ SHELL
- LIMESTONE
- CLAY

GROUNDWATER ANALYTICAL DATA (?g/L) - 6/98

EW-9 NOT OPERATIONAL AT PREPARATION OF THIS FIGURE

* GROUNDWATER FLOW AS DEPICTED REPRESENTS A SCHEMATIC TWO-DIMENSIONAL FLOW ALONG THE AXIS OF THE CROSS SECTION. THIS DEPICTION IS GRAPHIC ONLY AND DOES NOT REPRESENT ACTUAL FLOW OR MAGNITUDE.

250 125 0 250
SCALE HORIZONTAL FEET

Figure 9
CROSS SECTION C-C'
SHERWOOD MEDICAL INDUSTRIES
DELAND, FLORIDA

Source: ESE, 1999.

Project No.	3698019-0X00
Date	October 1999
Drawn By	D.J.T.
Checked By	M.J.G.
Approved By	M.J.G.

AMERICAN HOME PRODUCTS, CORP.

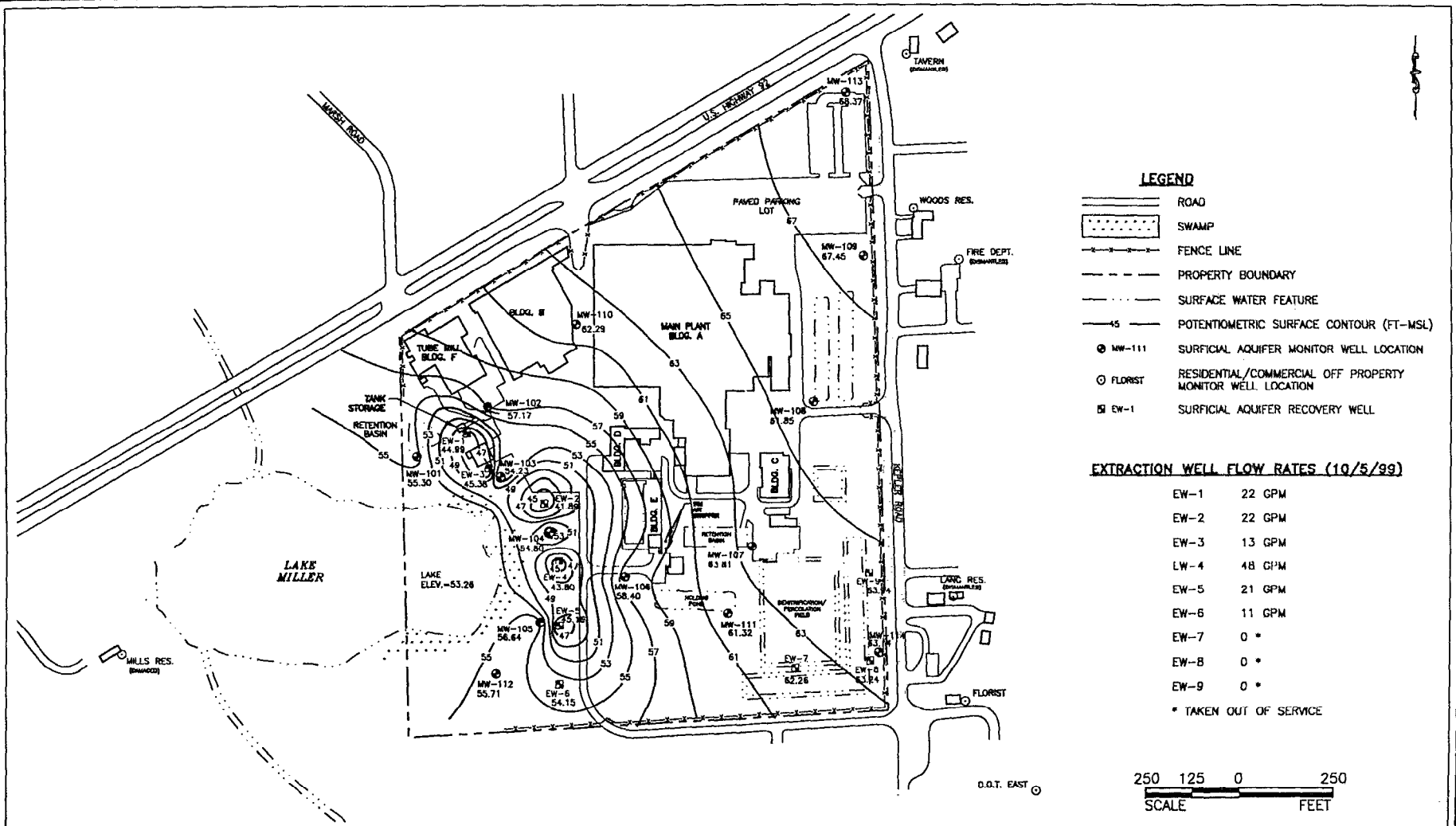


Figure 10
POTENTIOMETRIC SURFACE CONTOUR MAP - OCTOBER 5, 1999
SHERWOOD MEDICAL INDUSTRIES
DELAND, FLORIDA

Source: ESE, 1999.

Project No. :	3698019-0X00
Date :	October 1999
Drawn By :	D.J.T.
Checked By :	M.J.G.
Approved By :	M.J.G.

AMERICAN HOME PRODUCTS, CORP.

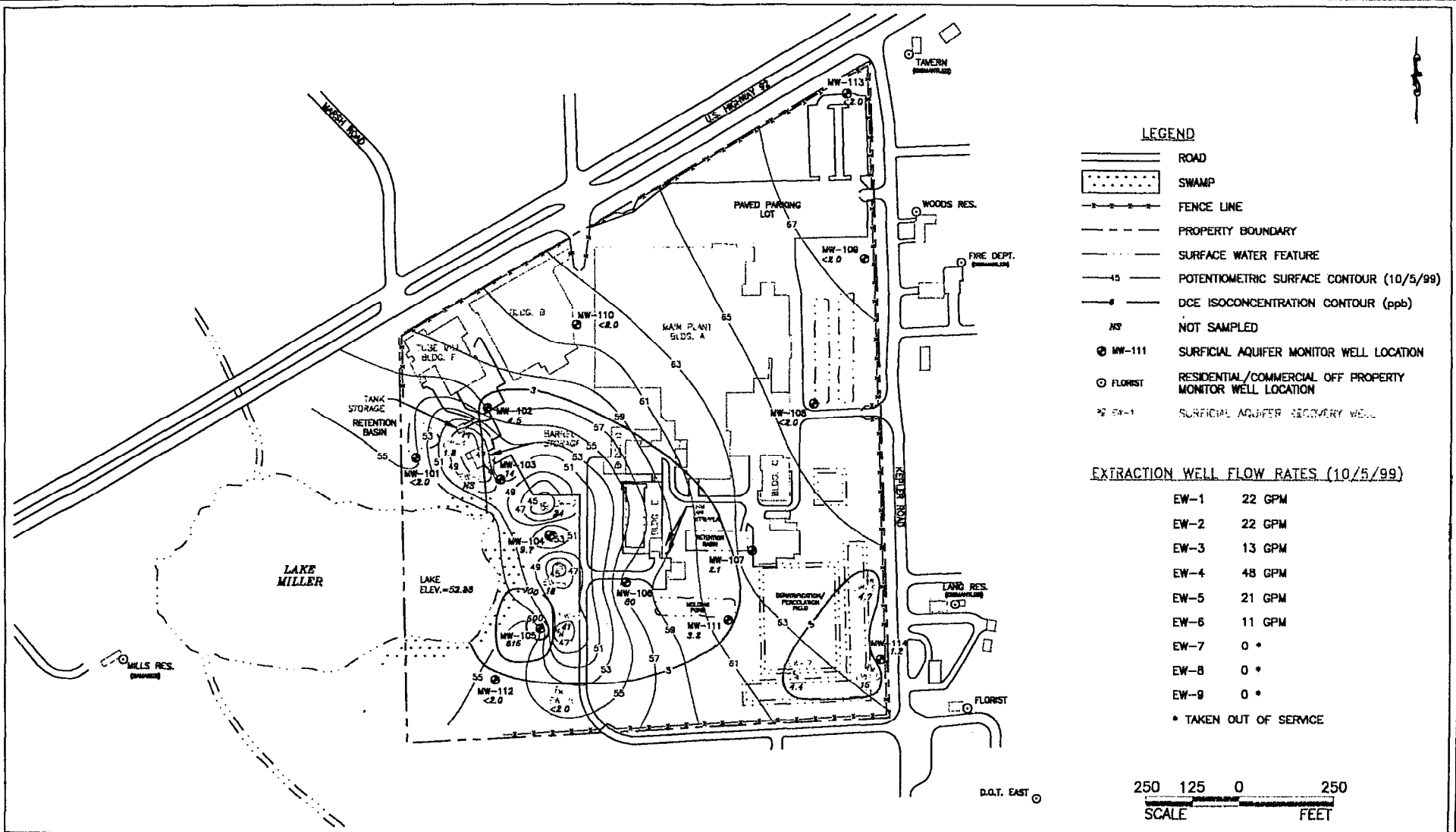


Figure 11
DCE CONCENTRATIONS IN SURFICIAL AQUIFER GROUNDWATER – JUNE 1999
SHERWOOD MEDICAL INDUSTRIES
DELAND, FLORIDA

Source: ESE, 1999.

Project No. :	3698019-0X00
Date :	October 1999
Drawn By :	D.J.T.
Checked By :	M.J.G.
Approved By :	M.J.G.

AMERICAN HOME PRODUCTS, CORP.

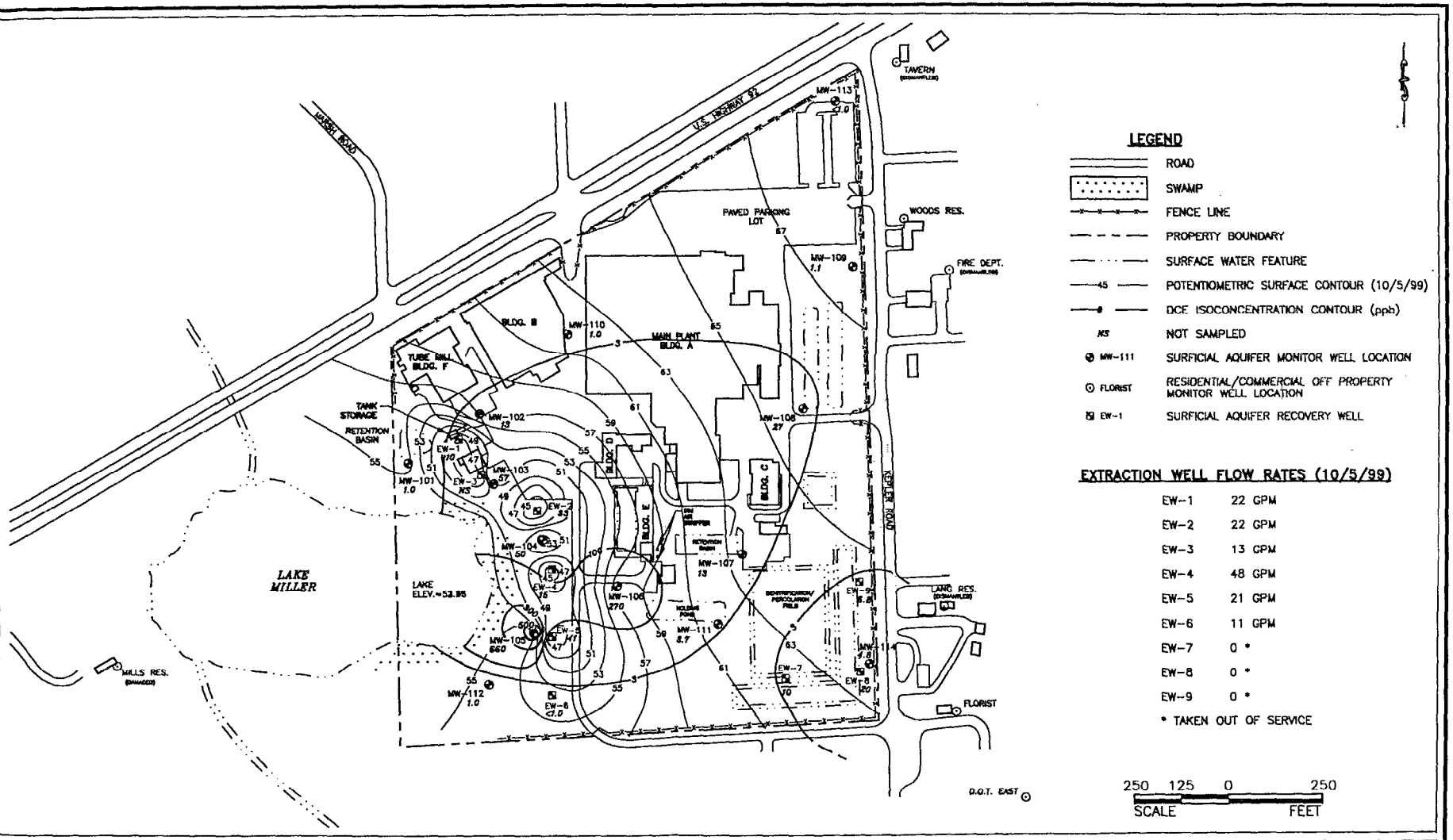


Figure 12
TCE CONCENTRATIONS IN SURFICIAL AQUIFER GROUNDWATER – JUNE 1999
SHERWOOD MEDICAL INDUSTRIES
DELAND, FLORIDA

Source: ESE, 1999.

Project No. :	3698019-0X00
Date :	October 1999
Drawn By :	D.J.T.
Checked By :	M.J.C.
Approved By :	M.J.G.

AMERICAN HOME PRODUCTS, CORP.

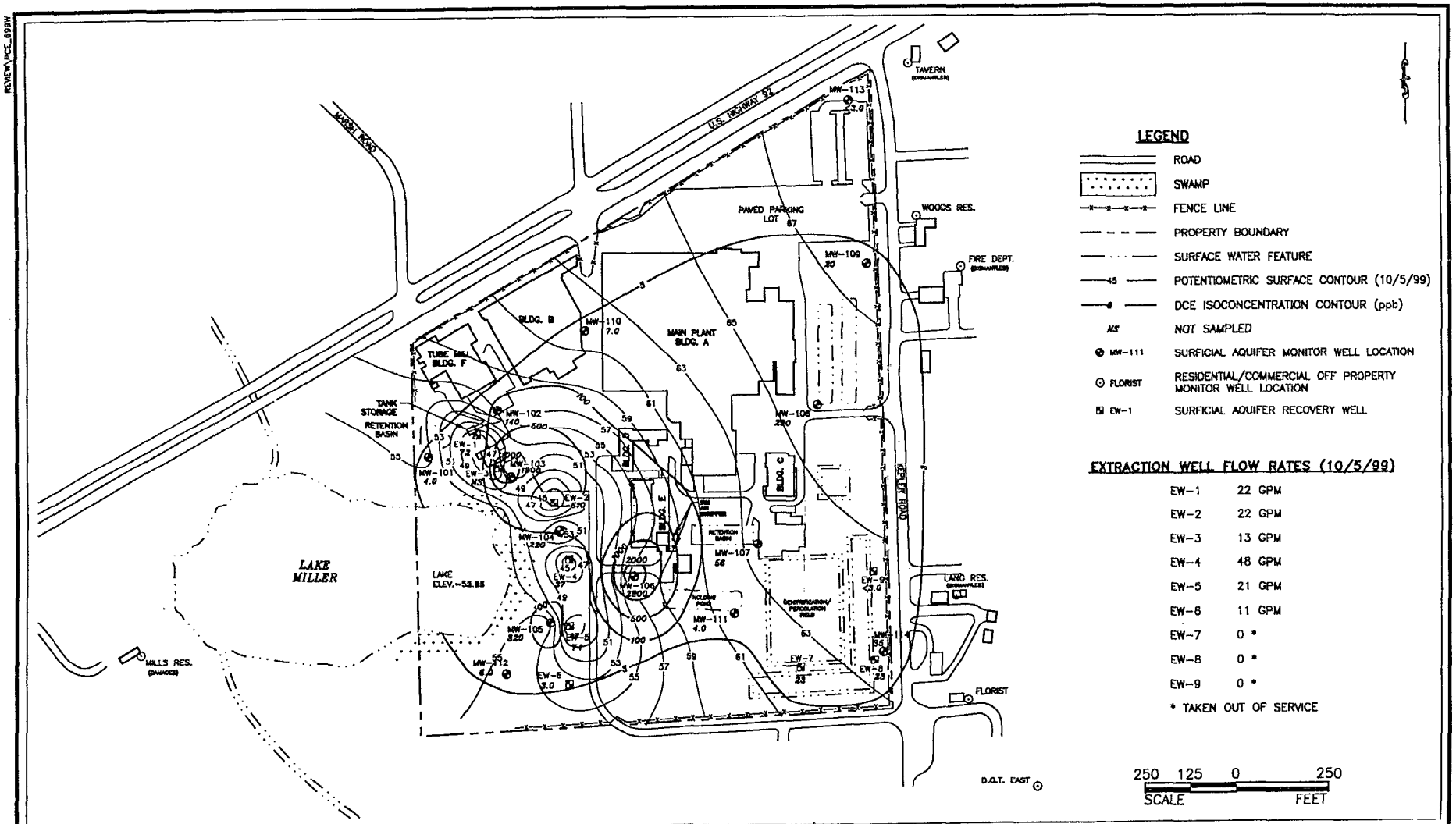


Figure 13
PCE CONCENTRATIONS IN SURFICIAL AQUIFER GROUNDWATER – JUNE 1999
SHERWOOD MEDICAL INDUSTRIES
DELAND, FLORIDA

Source: ESE, 1999.

Project No.	3695019-0X00
Date	October 1999
Drawn By	D.J.T.
Checked By	M.J.G.
Approved By	M.J.G.

AMERICAN HOME PRODUCTS, CORP.

ILLUSTRATIONS

Illustration 1. PCE Concentration Trend - Upgradient Wells

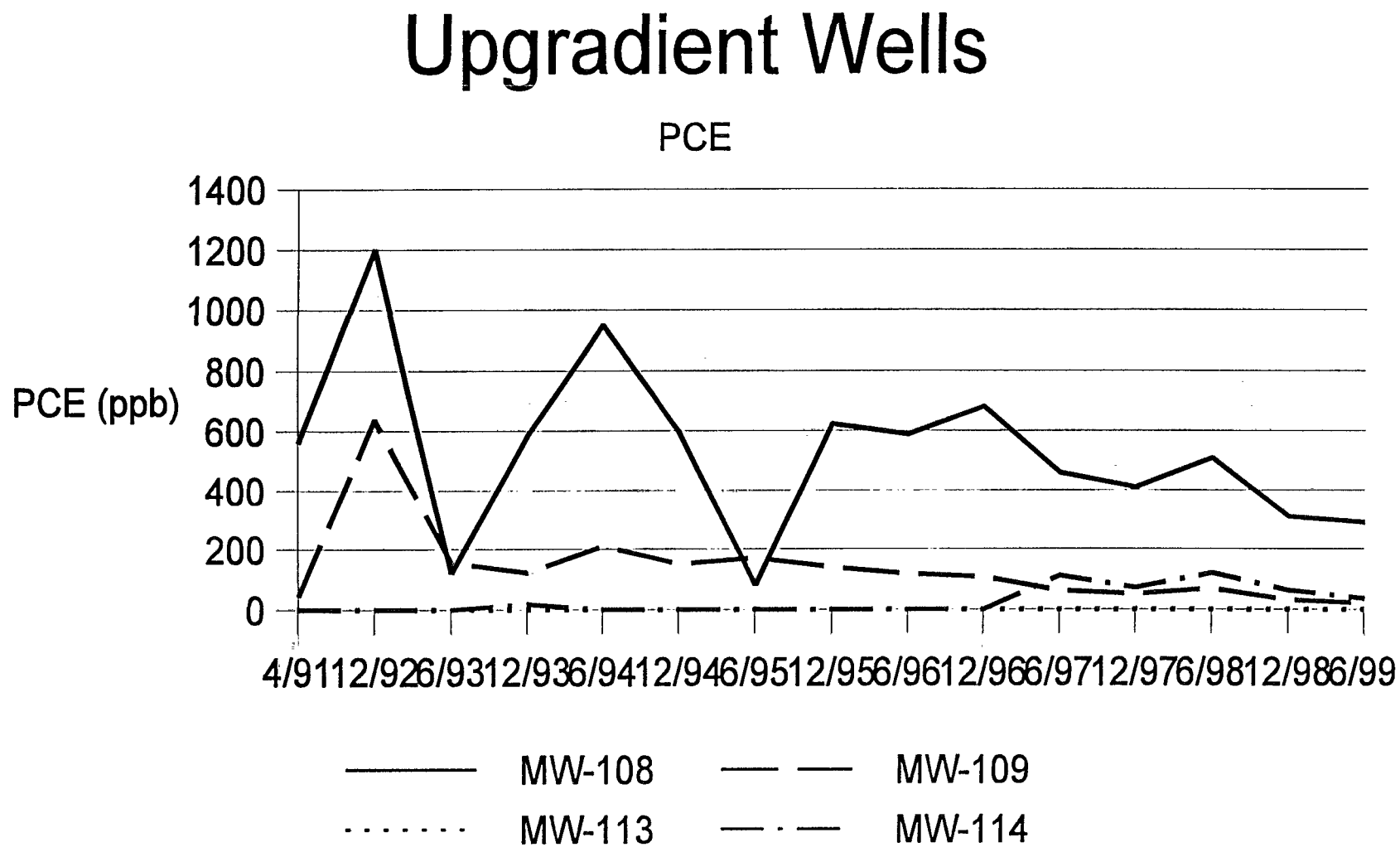


Illustration 2. PCE Concentration Trend - Perimeter Wells

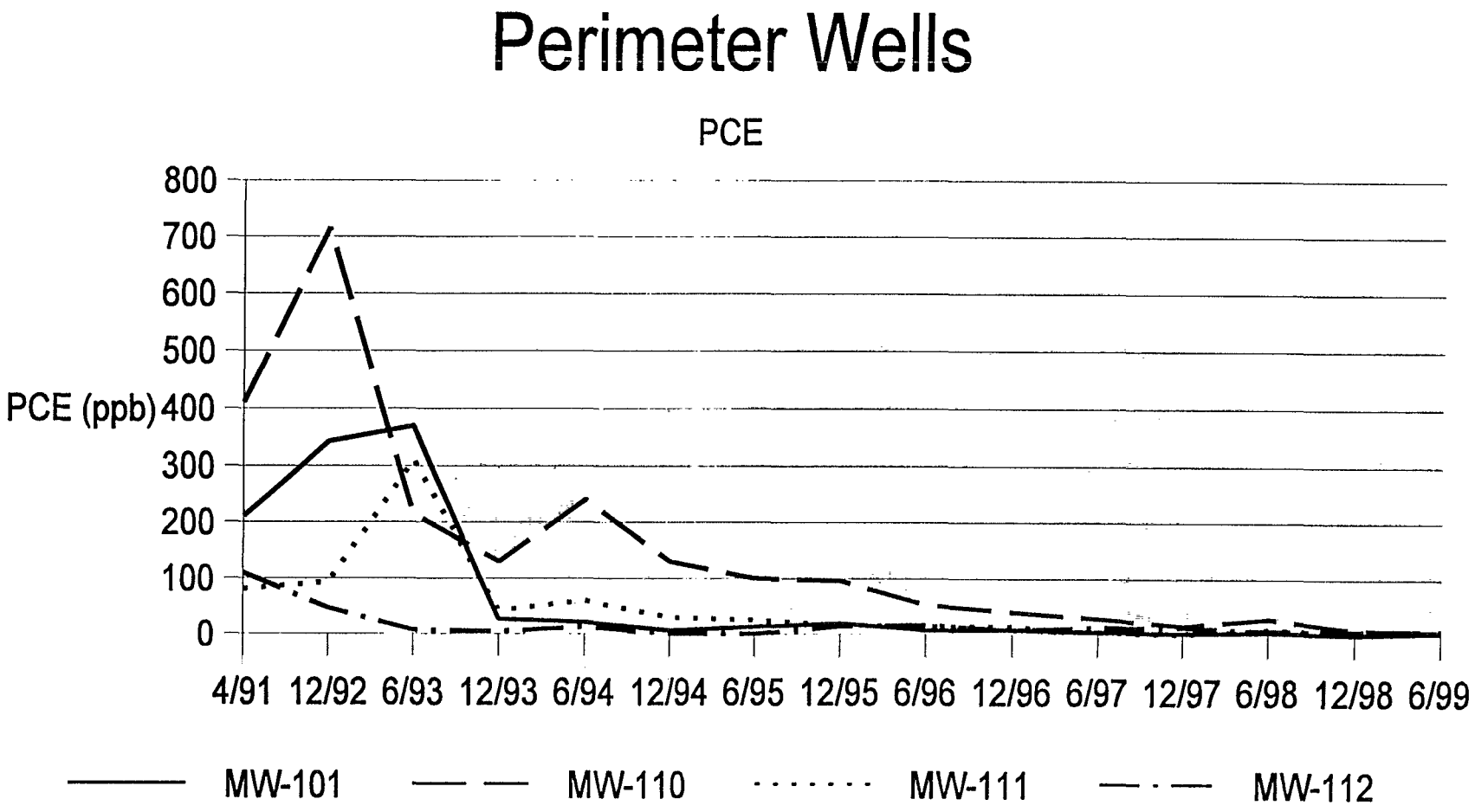


Illustration 3. PCE Concentration Trend - "Hot" Wells

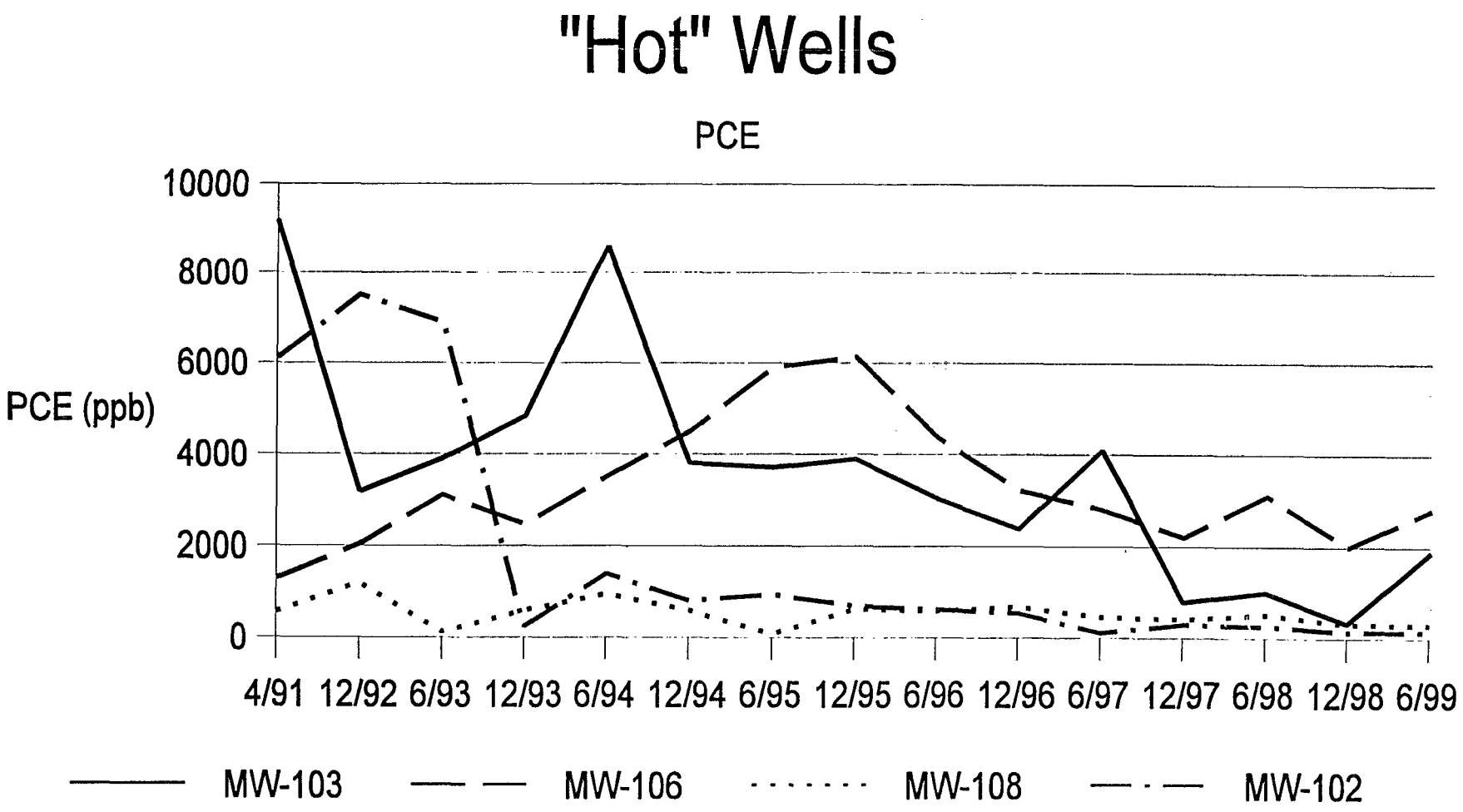


Illustration 4. PCE Concentration Trend - "Other" Wells

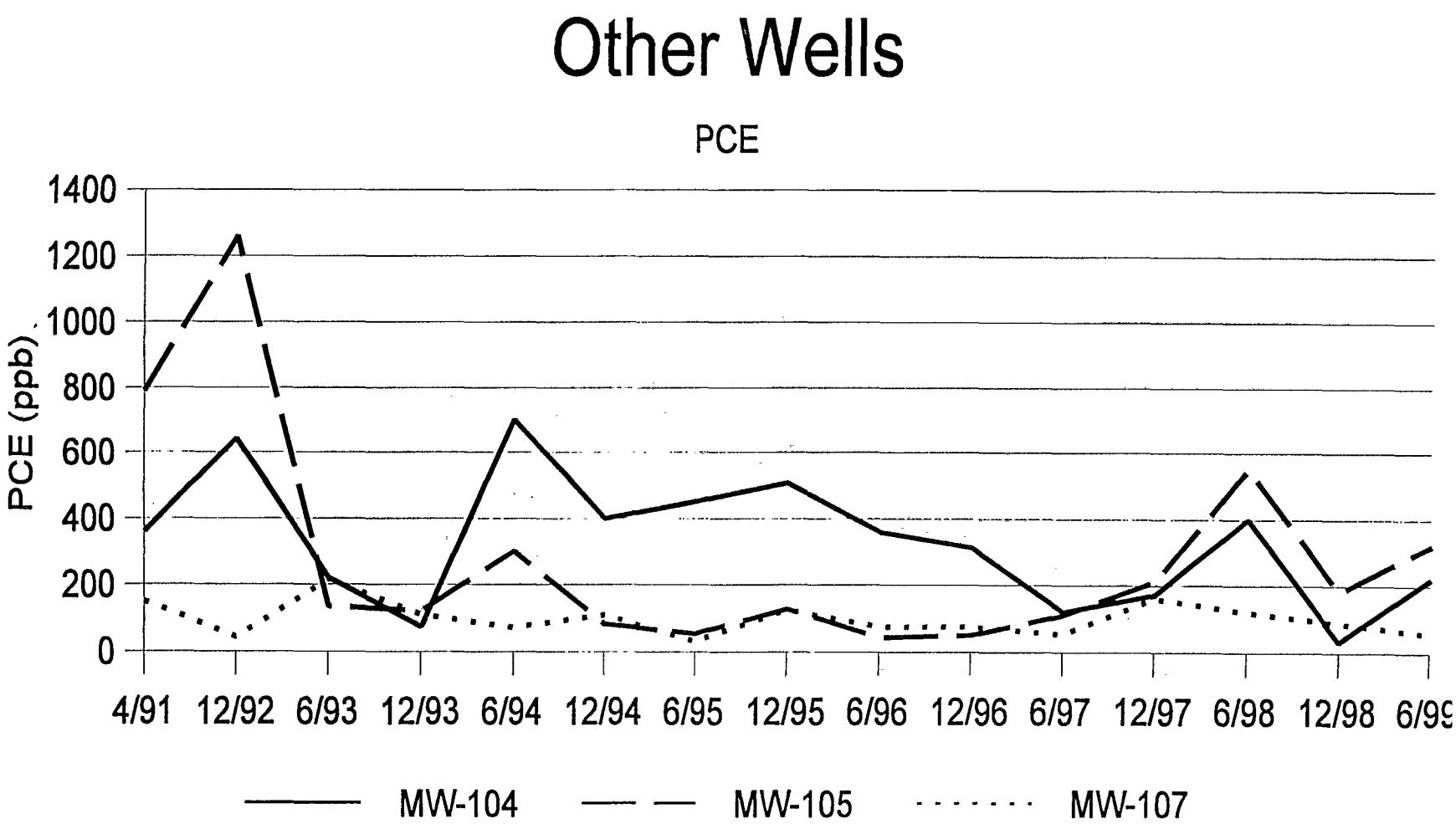


Illustration 5. TCE Concentration Trend - Upgradient Wells

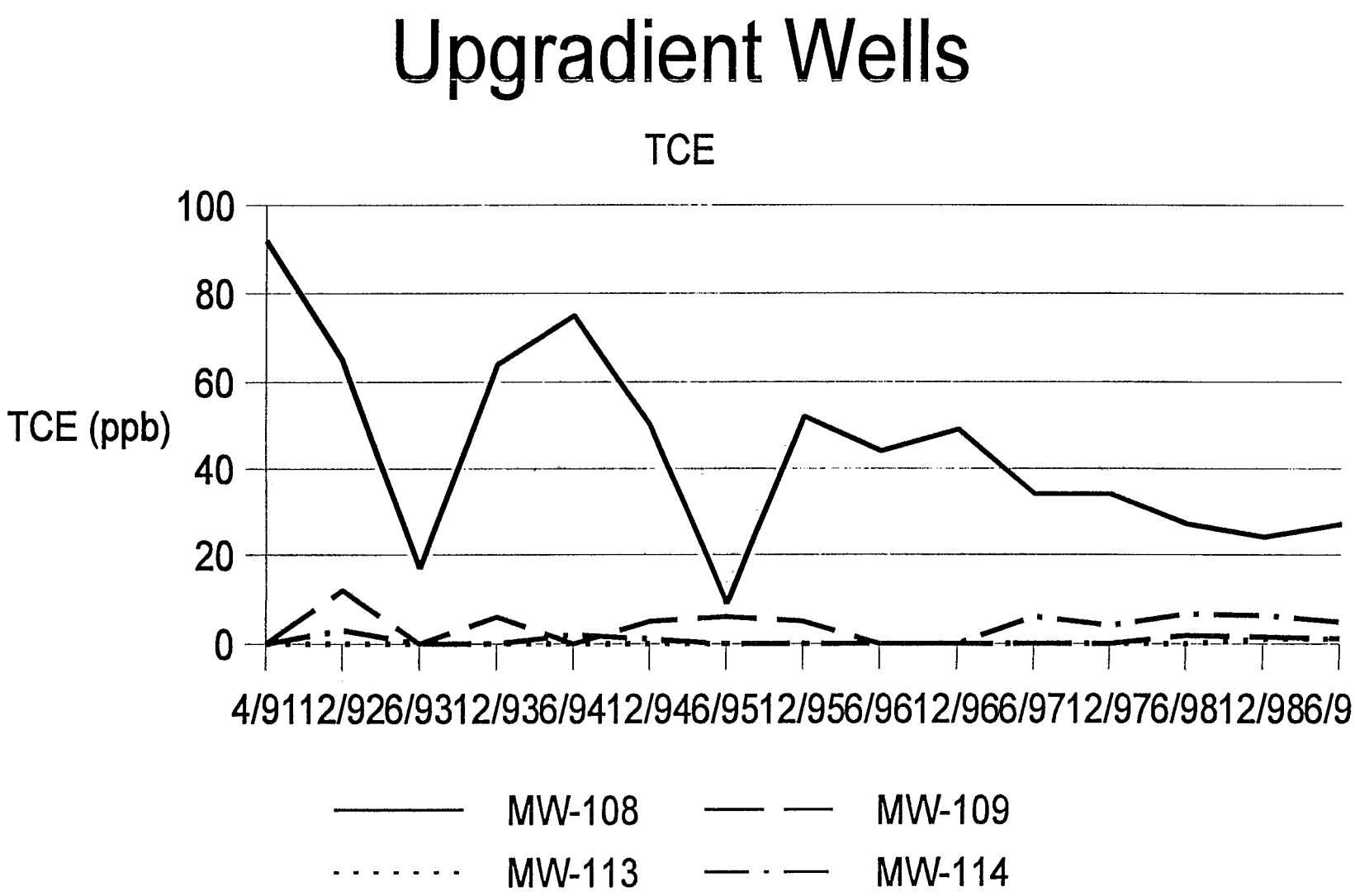


Illustration 6. TCE Concentration Trend - Perimeter Wells

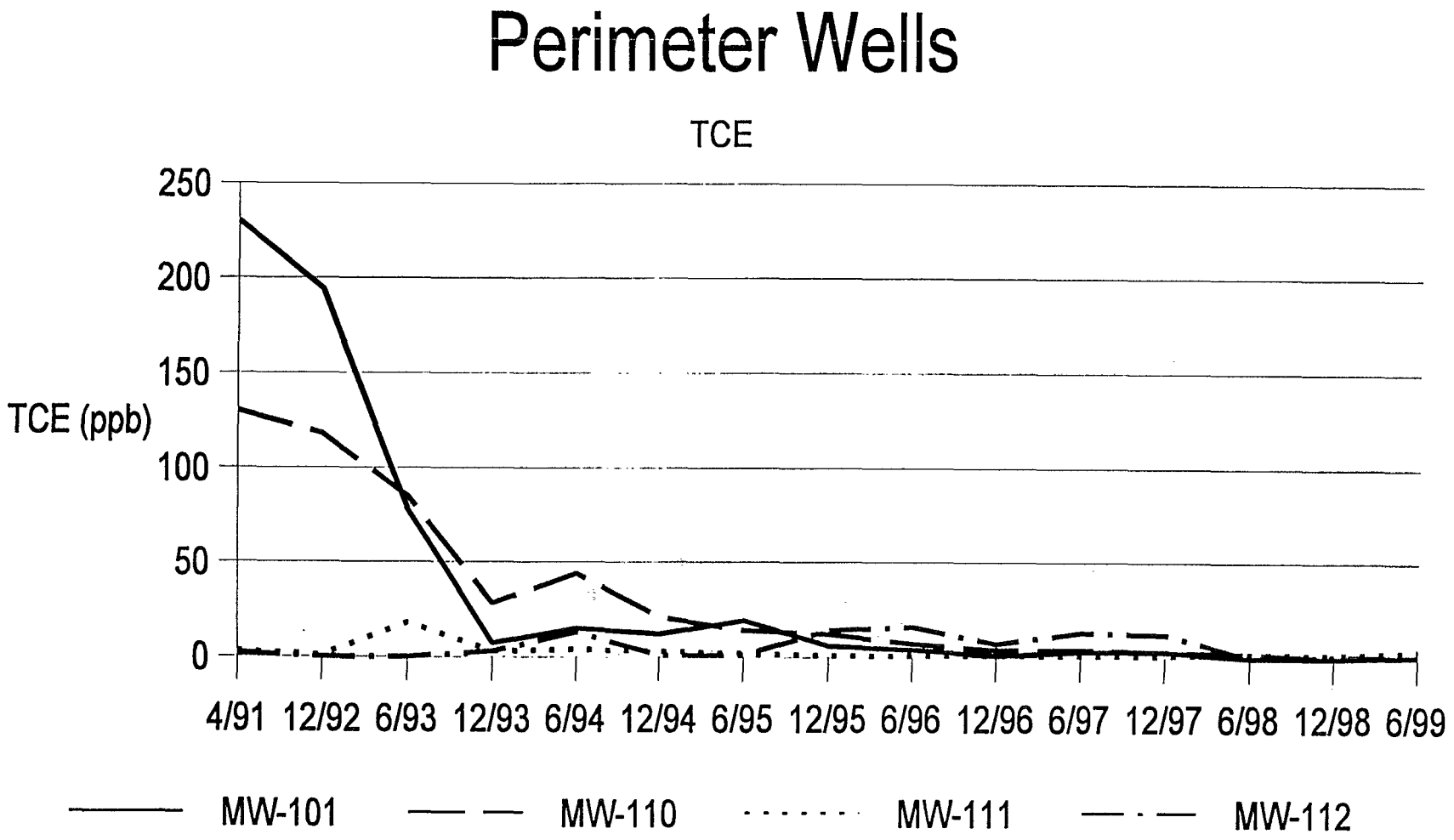


Illustration 7. TCE Concentration Trend -"Hot" Wells

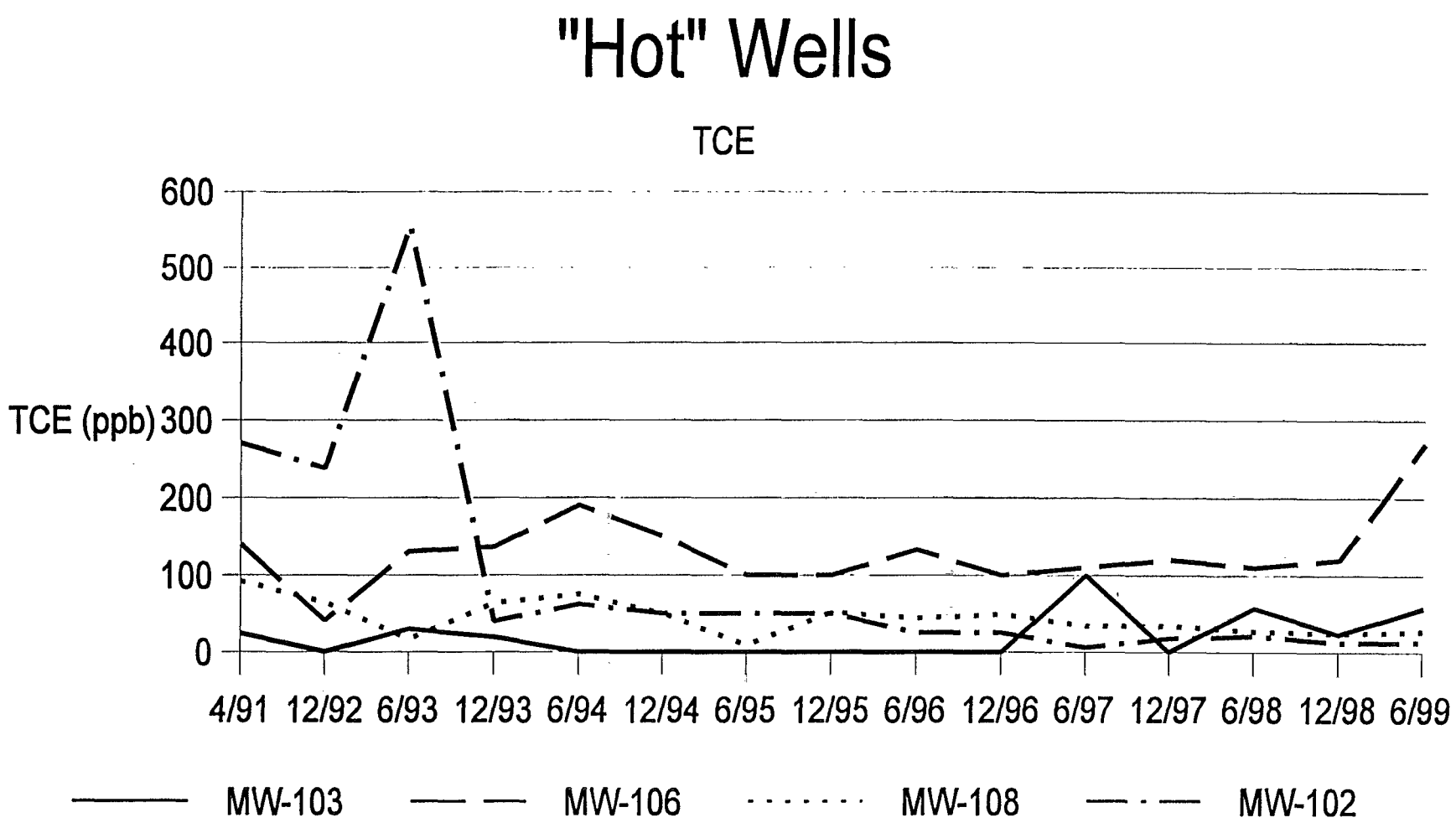


Illustration 8. TCE Concentration Trend - "Other" Wells

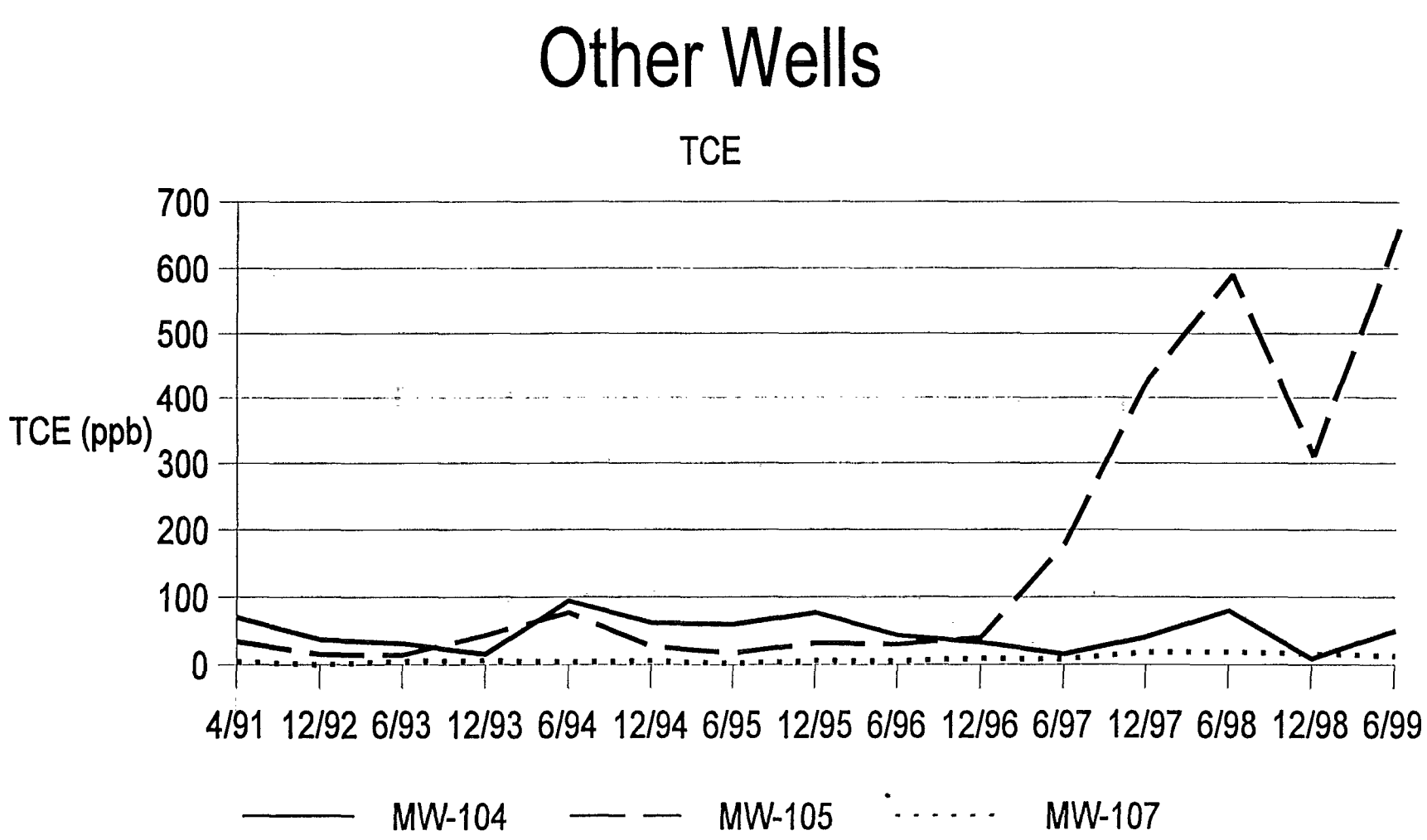


Illustration 9. PCE Concentration Trend - IRM Air Stripper

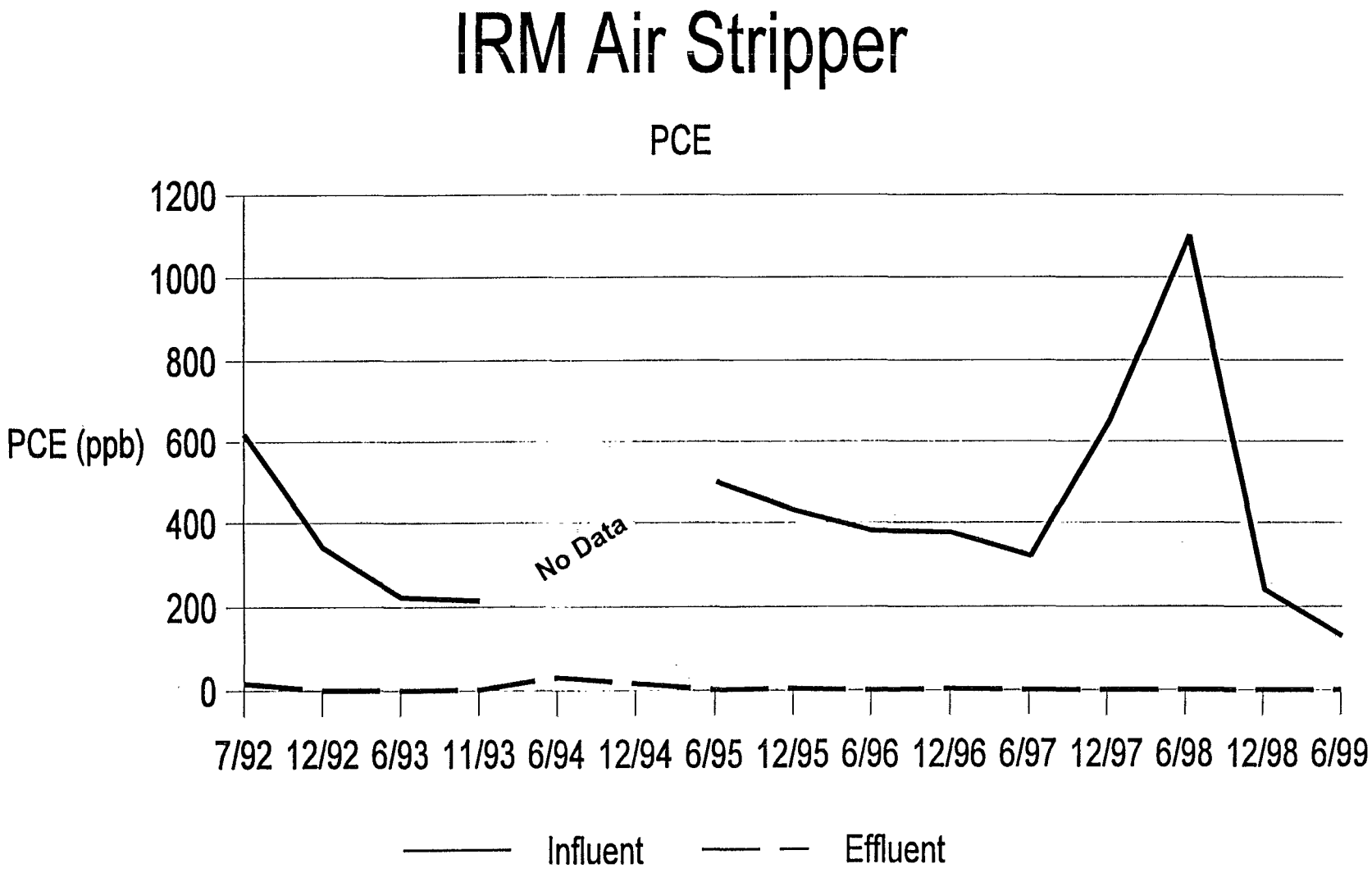


Illustration 10. TCE Concentration Trend - IRM Air Stripper

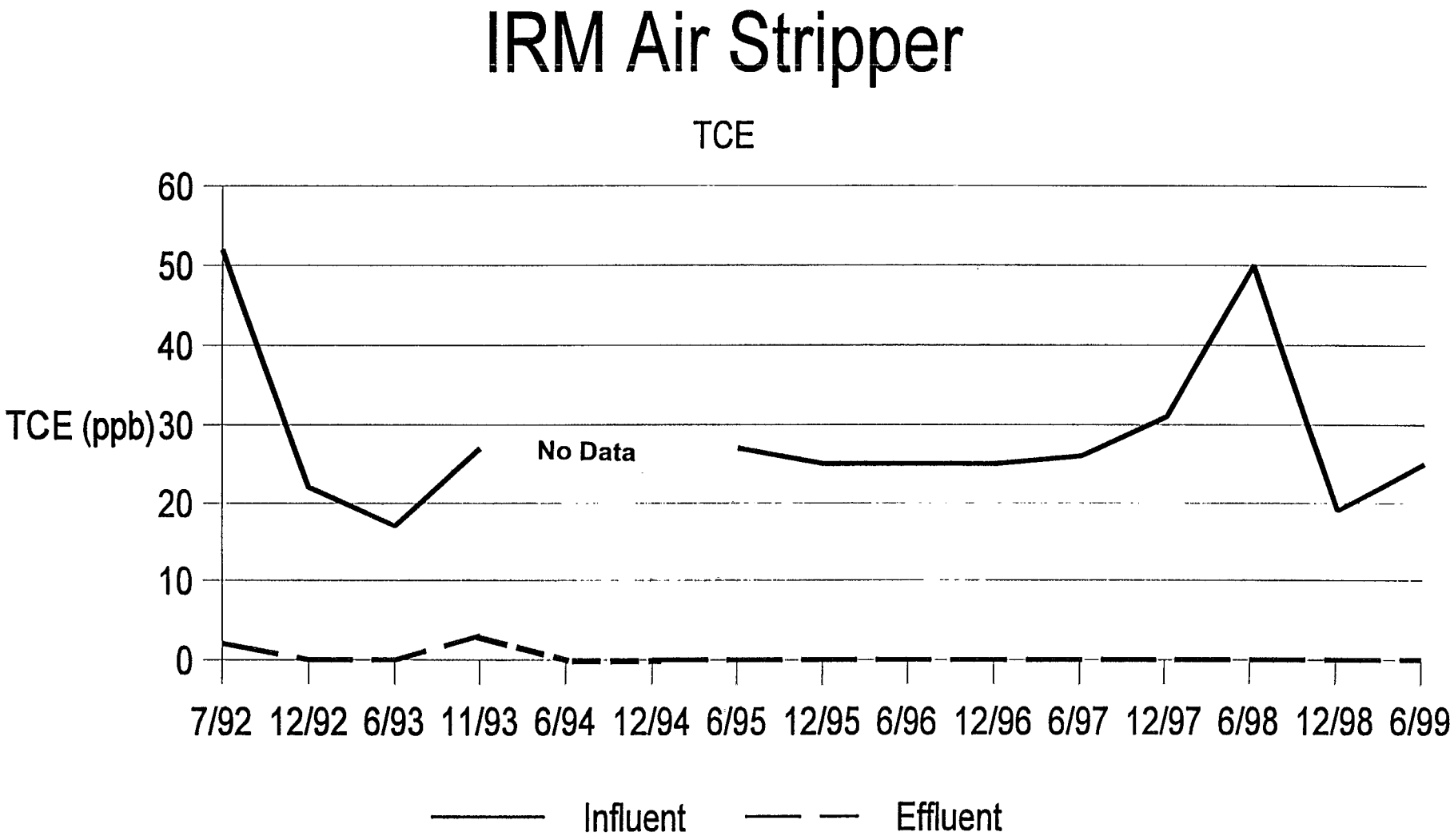


Illustration 11. Anaerobic Degradation of Chloroethenes

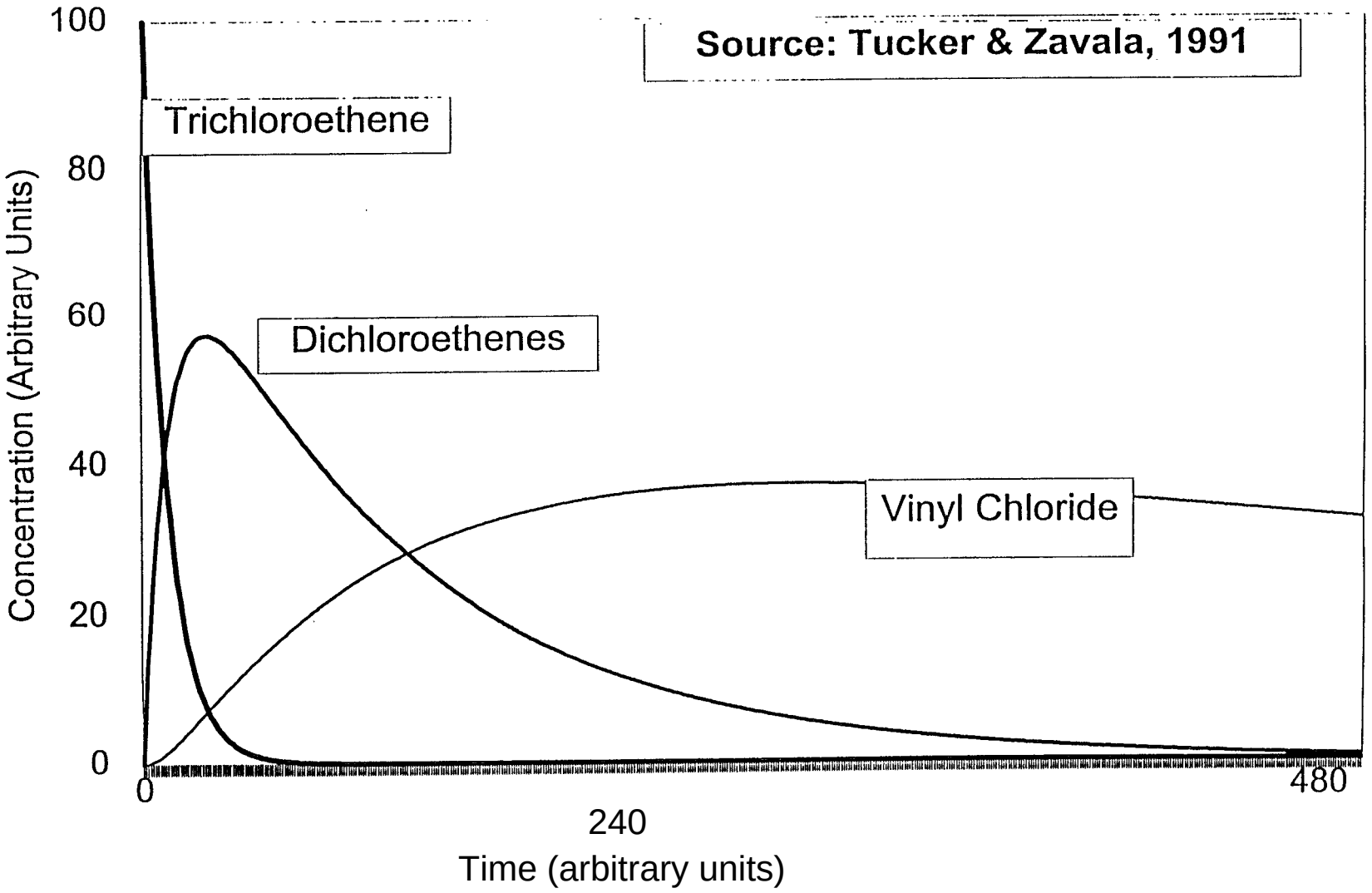


Illustration 12. **Chloroethene Composition Changes - All Surficial Wells (1994 - 1999)**

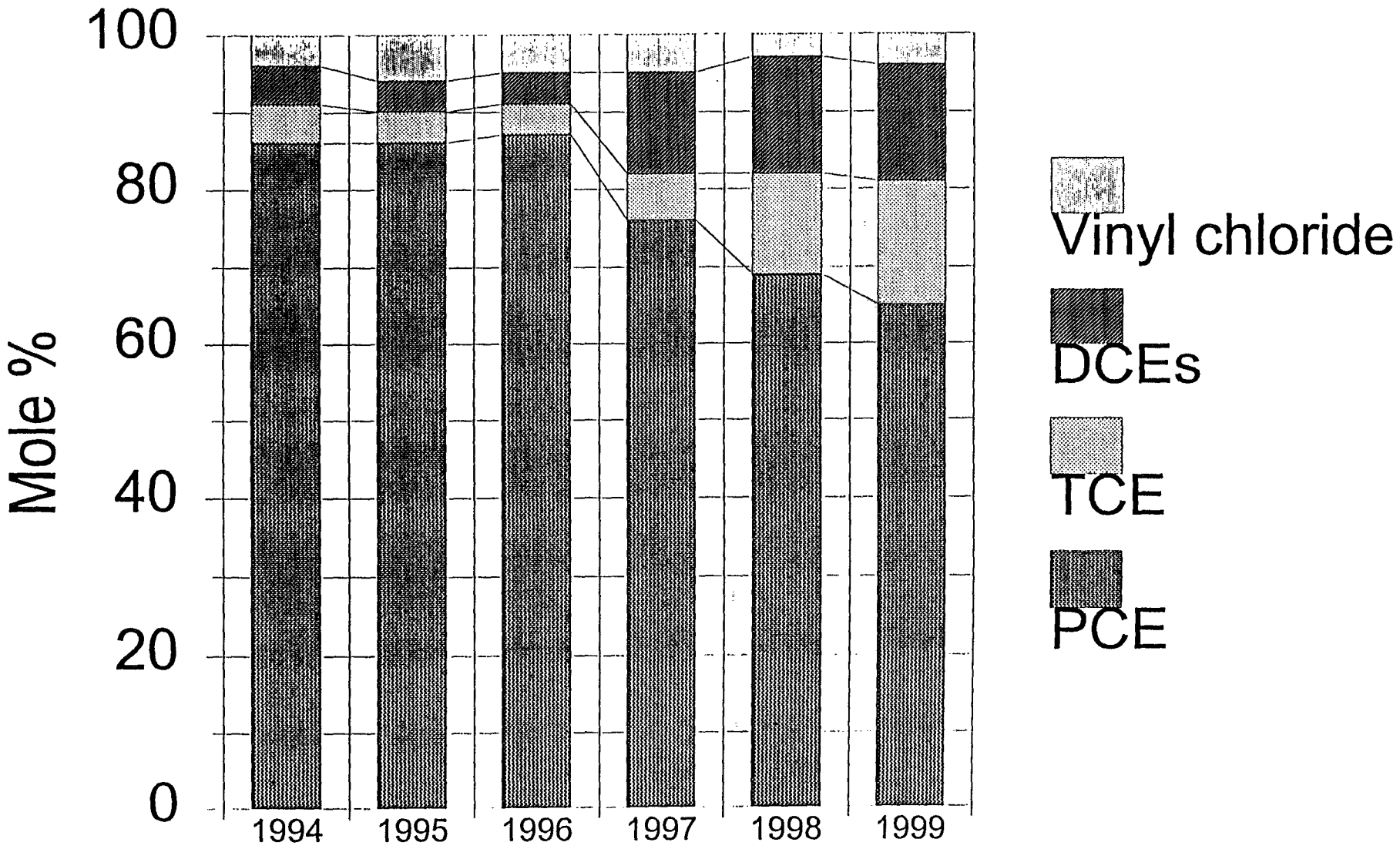
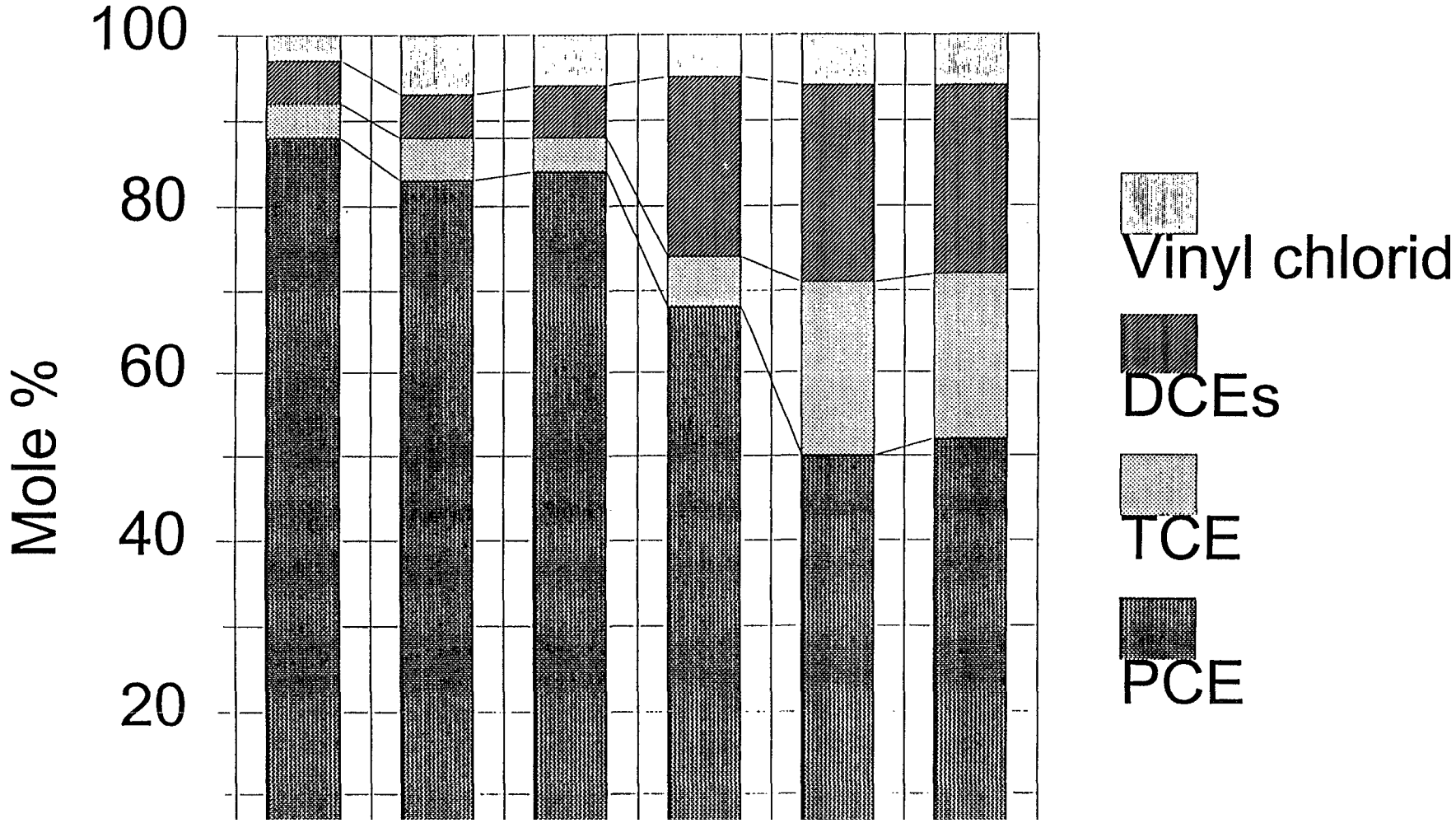


Illustration 13. **Chloroethene Composition Changes - MW-101, 102, 103, 104, 105 & 112 (1994-99)**



QORE
PROPERTY SCIENCES

December 3, 1999

WMD/SSMB
RECEIVED

DEC - 1999

EPA–REGION 4
ATLANTA. GA

United States Environmental Protection Agency
Mr. Mark Fite
100 Alabama Street SW
Atlanta GA 30303

Dear Mr. Fite:

RE: **5-year Record of Decision Review - Missing Map**
Sherwood Medical NPL Site - Deland Florida

American Home Products Corporation (AHPC) has completed the Five-Year Review for the above referenced site which was forwarded to you in November. I regret that Figure 11 was inadvertently left out of the production copies of the report. I am enclosing this figure for inclusion into your copies of the report and I apologize for any inconvenience this may have caused.

If at any time during your review you have any questions or require any additional information, please feel free to contact Mr. Howard at (973) 683-2288.

Sincerely,
QORE, Inc.

Michael J. Geden, P.G.
Alternate Project Coordinator

cc: AHPC, Mr. Perry Howard
FDEP, Ms. Laura Barrett
Tyco\Healthcare\Kendall, Ms. Jane Fugler